RAILROAD GAZETTE

FRIDAY, MARCH 9.

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Contributions.

The Cause of Shock.

TO THE EDITOR OF THE RAILROAD GAZETTE:

It seems plain to me that car collisions in train (shock) are the result of two (usually combined) causes: 1. *Free* slack; and, 2, lengthwise oscillation caused by the varying momentums and retardations of the several cars. Both varieties can be controlled by a simultaneous *and proportional* application of a train-brake. This, however, is a practical impossibility. Freight trains are likely to combine empty, loaded and partially loaded cars; cars equipped and unequipped with train-brakes, and equipped cars "cut out" because of faulty apparatus. The retardation of a fully braked car is 33 times that of an unbraked car, and of an empty car nearly three times that of a loaded one. These are sufficient differences to occasion oscillations, and, as is well known, slight successive oscillations can be productive of disastrous effects. The resilience of an ordinary buffer spring is equal to the tractive power of the ordinary freight locomotive; the combined length of the springs in 50 cars, say, 60 feet, and the permissible closure and extension equal to, say, 30 feet. It seems to me that these indicated factors of (1) differing momentums; (2) differing retardations, and (3) spring reactions, are sufficiently potent to account for the most damaging "shock," and it is certain that such wave-shock cannot be controlled by "simultaneousness." So that while shocks caused by free slack *can* be controlled by "simultaneous" applications of brakes, and in no other way, shock that results from oscillations *cannot* be so controlled. But, nevertheless, shock need never be encountered if only the following conditions be observed: 1. Couple trains so that there shall be *no* free slack. The Janney type of coupler does not fulfill this condition, but can be made to. 2. Equip the locomotive with a power brake that will establish a stopping tendency of the locomotive in excess of that of any car in train. 3. Have the wheel weight and brake efficiency of the locomotive such that its *resistance* shall be greater than the resilience of any of the buffer springs behind it.

The *resistance*, or brake-traction, of a brake is equal to $\frac{1}{3}$ of its *pressure*. Its pressure cannot safely exceed 80 per cent. of the wheel weight. It will, therefore, require 50 tons of wheel weight to endure a 40-ton brake giving 8 tons of resistance; and if the *total* wheel weight of locomotive and tender was submitted to a proportional pressure, the conditions above given would be satisfied, and a close-coupled train be stopped without shock. G.

[Some remarks on the subject of this letter will be found on another page.—EDITOR.]

The Proper Design for a Hoop Joint for a Water Tank.

RIVERSIDE, Ill., Feb. 18, 1888.

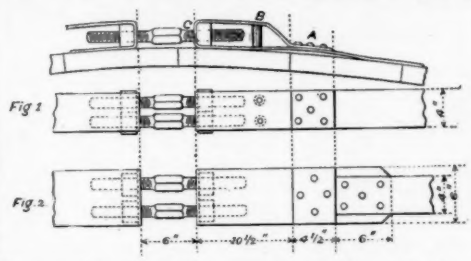
TO THE EDITOR OF THE RAILROAD GAZETTE:

I was interested in Prof. Johnson's article, in the *Railroad Gazette*, Jan. 6, giving a design for a hoop joint, which is none the less meritorious because it is not new. I used almost identically the same device in 1872, when building a 36 ft. tank for the village water-works at this place.

The design first adopted was that shown in Fig. 1, where short pillars *B* were used to keep the loop in shape and leave free room for the bolt ends. It was found necessary to make the holes in the ends of loops rather large to avoid injury to the bolt threads, and this weakened the hoops so that in some cases when severely strained they showed signs of weakness at point *C*. The hoop also left the surface of the tank at *A*, assuming the position of a tangent to the tank passing through centre of nut.

The staves were unfortunately subjected to a soaking rain before the hoops were got in place, with the result that it was found impossible to put on strain enough to secure tight joints all around, so it became necessary to add more hoops. These had the loops made of pieces of 6 in. by $\frac{1}{4}$ in. iron, riveted on, as shown in fig. 2, which, besides admitting of large bolt holes were expected to be stiff enough to allow dispensing with the pillars, and also not to bend away from tank at *A*. The first two expectations were realized, but not the third; there was the same gap at *A* (about $\frac{1}{16}$ in.)

There was no sharp bend, as might have been expected, but the same easy curve at *A* as in the first instance. The bolt holes being made large enough and the nuts playing a trifle loose in the loops there seemed to be no noticeable bending stress on the bolts, and with tapering wooden shims to fill up



the gaps at *A* and so bring a uniform bearing on the staves the joint seems perfectly satisfactory. Still I am not prepared to deny that Prof. Johnson's method of making the loop end circular, with flat-round washer bars under the nuts, may be an improvement, and if I had more tanks to hoop I believe I should adopt this form.

JAMES DUNCAN RAYNOLDS.

Railroads and Trade Centres.

21 PARK ROW, NEW YORK, Feb. 15, 1888.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Mr. Greene treats my paper on "Trade Centres" in the *Popular Science Monthly* very fairly on the whole, and I admit that the sentence he drags from its context does look very strangely as he prints it. But, "surely, surely," Mr. Greene does not suppose me capable of asserting that the more the traffic to a certain point, the higher the fares and the tariffs? I was writing of the comparative values of property situated at a point which had become (by operation of natural laws, as I claim) a trade centre, and of other property situated elsewhere; and suggesting that some parcel of the jealousy with which railroads are regarded might have its inspiration in the fact that they had not enhanced the value of the property situated elsewhere, but had still more enhanced the value of property already valuable by reason of its situation at a trade centre (had not, in fact, been able to reverse the Scriptural doctrine that to him that hath shall be given, etc.); and, on re-reading my paper at that point, cannot see anything very misleading in the sentence as it stands.

Neither does it seem to me that the testimony which Mr. Greene cites bears away very heavily upon my argument. I still maintain that, if an inland trade centre is necessary, the same laws which drew commerce to the water centres will operate to draw transportation to the inland centres. In the one case the best port was the port nearest to distributing conveniences, to mass of population, or to a dozen other features made desirable by the nature of things. In the other the best depot will, I think, be found not to be independent of these same considerations. I should want to cross-examine a witness very thoroughly before surrendering my suspicion that what he called "discrimination" was a wilful attempt of a railroad company to thwart the needs of the territory and the population through which it passed. Doubtless the railroad company would make the best rates to a depot which made the greatest demand upon its carrying capacity, which gave it the largest orders. Witnesses of the highest reliability, when testifying to facts, sometimes wander very largely afield when asked their opinion as to the proximate causes of those facts; but, when local jealousies are added to the general tendency, some very remarkable testimony is apt to be elicited. I am not unfamiliar, and was not when writing the *Popular Science Monthly* paper unfamiliar, with the investigations to which Mr. Greene alludes. But I am afraid I must still remain skeptical as to the power even of a railroad company to resist, reverse or compel the laws of Supply and Demand. As to the Inter-state Commerce law (though I admit that the present Commission are not allowing it to bear as heavily against the railroad companies as its letter warrants them), I still think it despotical and unconstitutional (as I read it) or else (as its apologists read it) entirely superfluous and unnecessary. If it cannot be abolished (as I think it ought to be) it would be patriotic to so amend it as to give our own railroads—into which our own people have put their capital—some little chance as against the British-Canadian railways in the bid for continental business.

APPLETON MORGAN.

The Engineers' Slide Rule.

BY E. A. GIESELER, C. E.

Various forms of this ingenious time and labor-saving contrivance have been devised, but all of them are based on the principle of the logarithmic scale; that is, a scale on which the distance of each figure from the initial point represents the mantissa of the logarithm of such figure.

In the case of the slide rule the logarithmic scale extends from 1 to 10; the initial point being 1, the logarithm of which is 0, the distance from 1 to 2 corresponds to logarithm 2, the distance from 1 to 3 corresponds to logarithm 3, and so on. In other words, the logarithms are plotted and the points marked with the number pertaining to each logarithm. It is easy to see that with such a scale the multiplication of two figures can be executed by graphically adding their logarithms. In order, for instance, to multiply 2 and 4, the two lengths pertaining to logarithm 2 and logarithm 4 may be added by means of an ordinary compass, and then by laying off the total length thus obtained on the scale with one point of the compass at 1, the desired result, in this case 8, will be found under the other compass point.

When the scale is properly subdivided, not only the full numbers 1, 2, 3, 4, etc., can be read off, but also intermediate values, such as 1.72, 3.65, etc., and multiplications of these are then also feasible. Inasmuch as the mantissa of the logarithm is independent of the position of the decimal point of the number, by means of the subdivision of the scale multiplications, such as the following, can also be executed: $172 \times 36 = 6192$, care only being taken to put the decimal point of the result in its correct position, rules for doing which will be given below.*

The compass is advantageously replaced in the slide rule by a second logarithmic scale, divided in precisely the same way as the first one, and arranged so as to slide along it, as indicated in fig. 1. In order to multiply two figures by each

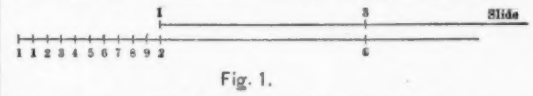


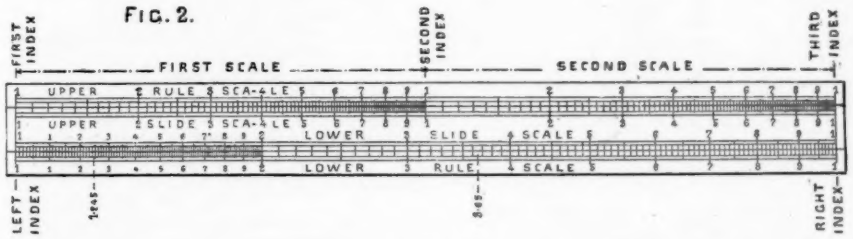
Fig. 1.

other, for instance 2 by 3, the left initial point of the second logarithmic scale—*the slide*, as it is called—is set at either one of the factors, say 2, on the original scale—the *rule*, as it is called—then the other factor, 3, is looked for on the *slide*, and opposite it the product, 6, is read off on the *rule*. In this way the addition of the two logarithms is accomplished in a more convenient manner than by the use of a compass.

The slide rule in its practical form is made of well seasoned box or mahogany wood. In a later form recently introduced by Messrs. Keuffel & Esser, of this city, it is made of mahogany and inlaid with celluloid, on which are engraved the graduations, the strong contrast between the white ground of the celluloid and the black lines rendering the reading easier than in the case of the less distinct graduations on wood.

The upper and lower edges of the rule as well as the slide are graduated, the corresponding graduations being perfectly identical on rule and slide. The lower graduations run from 1 to 10, covering the entire length of the instrument, and are called the *lower scales*. On the same length there are two upper graduations (that is, two on the slide and two on the rule) also running from 1 to 10, each of which is therefore half as long as the lower graduations. The upper scales are termed the *first scale* and the *second scale*; the left hand initial point of the lower scale is called the *left index* and the right hand end of the same scale is called the *right index*. The left hand initial point of the first scale is called the *first index*, the left hand initial point of the second scale is called the *second index* and the right hand end of the same scale is called the *third index*. With these various terms the reader is requested to make himself familiar, as they will be frequently referred to in the following. They are further illustrated by fig. 2, which is an accurate representation of the instrument in one half of the full size, with these differences from the original that the subdivisions are not fully carried out everywhere on account of their smallness, and that the above named designations are printed in the illustration.

FIG. 2.



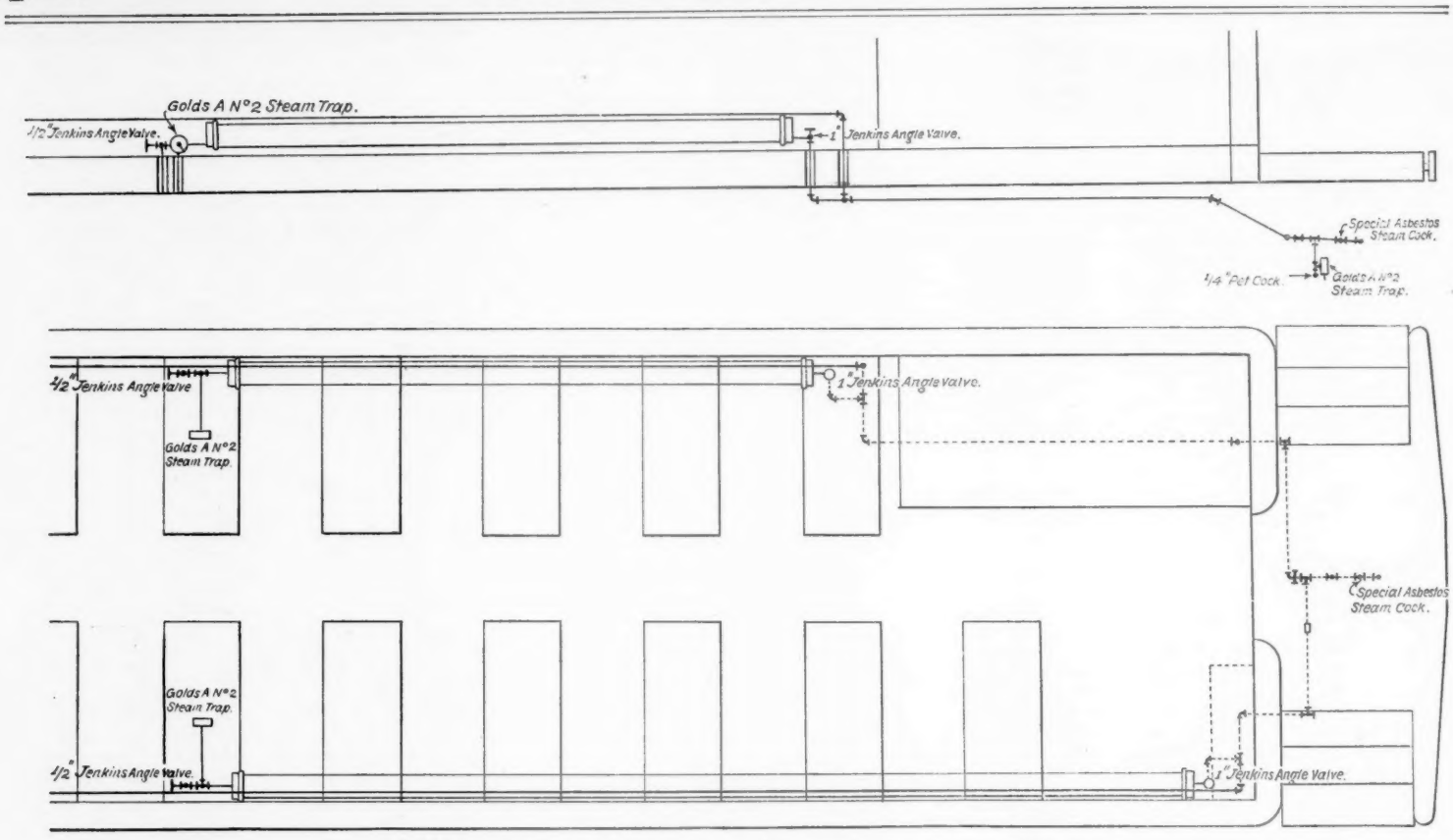
The first requirement for the successful use of the slide rule is the ability to read the graduations rapidly and correctly. This ability can only be acquired by actual practice; the underlying principle, however, will be easily understood from what has been said before, and from the examples of figures read, given in fig. 2.

The two lower scales, which will first occupy our attention, are graduated alike, each of them containing the lengths of the logarithms for all numbers from 1 to 10, including the intermediate values, such as 1.57, 3.66, 7.85, etc. While in most cases the third digit can be read off direct, a good eye will be able in many cases to read the fourth digit by estimating.

Multiplication.

It has already been shown how the multiplication of two figures is carried out by means of the slide rule, when the result *does not* lie beyond the right end of the rule, and it now remains to consider the way of proceeding in case the result *does* lie beyond the right end. By looking at fig. 3 it will be

* These rules have been left out here to save space, and because in most cases of practical use the position of the decimal point is readily determined by a glance at the figures of the problem. Economy of space also compelled us to leave out the extraction of the third and fourth root, all of which matter will be found in the author's pamphlet, published by Messrs. Keuffel & Esser, of this city.—EDITOR RAILROAD GAZETTE.


Golds A N°2 Steam Trap.
1/2" Jenkins Angle Valve.
1" Jenkins Angle Valve.
Special Asbestos Steam Cock.
1/4" Pet Cock.
Golds A N°2 Steam Trap.
1/2" Jenkins Angle Valve
Golds A N°2 Steam Trap.
1" Jenkins Angle Valve.
Special Asbestos Steam Cock.
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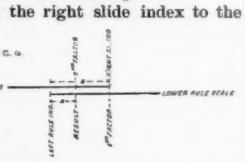
1/2" Jenkins Angle Valve.
1" Jenkins Angle Valve.

GOLD'S SYSTEM OF CONTINUOUS HEATING—LEHIGH VALLEY RAILROAD.

apparent that we have in this case log. of 1st factor + log. of 2d factor = log. A + 1, and all that is necessary in order to find the result would be to prolong, that is to repeat, the rule scale under the projecting end of the slide, so as to be able to read off A.

The same result could evidently be attained, without actually prolonging the rule scale, if we could find a way to set the second factor to the same distance A from the left rule index, at which it now stands from the right one.

This can be done by setting the right slide index to the first factor, that is by "reversing" the slide as shown in fig. 4. The distance between left rule index and first factor thus clearly is equal to B, fig. 3, and the distance between second factor and right slide index remains unaltered, consequently the difference A between these two distances in fig. 4 must be equal to their difference A in fig. 3, and the reading on the rule must therefore render the same result as if the rule scale had been actually prolonged beyond its right end.



When it is desired to multiply a series of figures by one and the same factor, then a single setting of the instrument only is required to read off all the various results, and it is in cases of this kind that the advantages of the slide rule appear in a most striking way. Let it be desired for instance to convert nautical miles into statute miles, then the index of the slide (in the following particular case the left one) is set to the converting factor, which is 1.136 (one nautical mile = 1.136 statute miles), and the results are now read off successively as follows :

16.3 nautical miles..... = 18.52 statute miles.
25.0 " " ..... = 28.41 " "
3.7 " " ..... = 4.21 " "
etc., etc.

Division.

This is performed by reversing the process of multiplication. The divisor is looked for on the lower slide scale and set opposite the dividend on the lower rule scale, then the result is read off on the latter opposite the left or right slide index, the choice between which can never be doubtful, as only one of them will stand within the graduation of the rule

Example: $\frac{25.6}{4}$. Find 4 on *lower slide* scale and set it opposite 25.6 on *lower rule* scale; then read off result, 6.4, on *lower rule* scale opposite *right slide* index.

Proportion.

Example : $\frac{33 \times 2.7}{14.5} = 6.145.$

The entire operation may be considered as consisting of two distinct parts :

1. The dividing of 33 by 14.5.

2. The multiplication of the result by 2.7, and in accordance with this the solution is found.

In order to carry out the division, we set 14.5 on the slide opposite 33 on the rule; the rule reading opposite, the left slide index would now give the result of the division. Instead of taking this reading, however, we take the rule reading opposite 2.7 on the slide, and thus carry out the multiplication also. In case the result lies beyond the end of the rule, then the quotient resulting from the first operation is read, the other index set to it, and the final result then read off as before.

For instance, $\frac{63 \times 31}{17}$. Set 17 on slide opposite 63 on rule; 31 on slide now lying beyond the rule, read off the result of division, which is 3.705; then set right slide index to this figure and read off final result, 114.9 on rule opposite 31 on slide. The reading of the quotient can also be avoided by setting the metallic runner to it, thus fixing its position in an easier and simpler way.

The multiplication of more than two factors with each other can be executed without reading the intermediate results by setting the runner to them, and then setting the right or the left index of the slide, as the case may be, to the point indicated by the runner on the rule. For instance, $24 \times 16 \times 13.5 \times 45 = 233300$. The left index of slide is set to 24, and the runner to 16 of the slide, thus fixing the product of the first multiplication ; then the left index is set to such product and the runner slipped to 13.5 of slide, thus fixing the product of the second multiplication; then the right index is set to such product and the final result read off on the rule scale opposite 45 on the slide. Repeated division can be executed in a similar way by using the runner, without reading the intermediate quotients.

A combination of repeated multiplications and repeated divisions is also executed in the same way, and here it will be found of advantage always to work a factor and a divisor together as far as this can be done. For example :

$$\frac{71 \times 21.4 \times 35 \times 17}{8.5 \times 42 \times 5.8 \times 20} = 21.8.$$

85 on the slide is set to 71 on the rule and the runner set to 214 of slide; then 42 on the slide is set to the point indicated by runner and the latter slipped to 35 of slide; then 58 on the slide is set to the point indicated by the runner, and 17 of slide now being beyond the left end of scale, the runner is slipped to the right index of the slide; then 20 on the slide is set to the point indicated by the runner, and the final result is read off on the rule scale opposite 17 on the slide.

The Upper Scales and Squares and Square Roots.

We have, up to now, performed all operations by the exclusive use of the lower scale on rule and slide, and we have mentioned the upper scale only in the general description of the rule. The upper scale, like the lower one, is a logarithmic scale, and precisely alike on rule and slide. Its unit, however, is only half as long as the unit of the lower scale. It therefore contains two logarithmic graduations from 1 to 10 each in the same space in which the lower scale contains only one. We can, therefore, use the upper scale for all operations that can be performed on the lower scale, with this advantage, that the reversing of the slide is not required; but also with this disadvantage, that, the graduation being closer, it does not allow the reading of as many places.

The unit of the upper scale being only half the length of the unit of the lower scale, it is clear that opposite a figure a on the lower scale there must stand a figure b on the upper scale, the logarithm of which is equal to twice the logarithm of a. The number corresponding to 2 log a is a^2; consequently opposite each figure a on the lower scale we find its square on the upper scale, or vice versa, opposite each figure b on the upper scale we find its square root on the lower scale. We have, however, to distinguish according to the following explanation between the figures b of the upper scale that contain *even* powers of ten and those that contain *uneven* powers of ten. The square roots of the first named have to be looked for in the *left* half of the lower scale or under the *first* upper scale, and the square roots of the last named have to be looked for in the *right* half of the lower scale or under the *second* upper scale.

The square root of a figure can also be found by means of the lower scale only, in the following manner : By means of the runner the position of the figure, the square root of which is to be found is fixed on the lower rule scale and then the slide is moved so far that its reading opposite the runner is equal to the reading on the rule opposite the left or the right slide index, as the case may be. For instance, to find the square root of 45 we set the runner to this figure on the lower rule scale and then commence to move the slide to the left; during this movement the reading on the slide opposite the runner will gradually increase, while the reading on the rule scale opposite the right index will gradually diminish ; finally a point will be reached when both readings are equal and then each of them must represent the square root of 45 according to former rules.

We find in this case $\sqrt{45} = 6.705$.

Wherever the finding of the square root only is desired, not combined with any other operation, then this way of proceeding is to be preferred, the lower scale always yielding more exact results But where the problem to be solved is of a more complicated nature, it will be found of advantage to use both scales. In this way and with the additional help of the runner all of the following problems can be easily solved:

$$a^2 \cdot b, \quad \frac{a^2}{b}, \quad \frac{a^2\,b}{c}, \quad \frac{a^2\,b}{c^2}, \quad a\sqrt{b}, \quad \frac{\sqrt{a}}{b}, \quad a\frac{\sqrt{b}}{c},$$

$$a\sqrt{\frac{b \cdot c}{d}}, \quad a\frac{\sqrt{b\,c}}{d\,e}, \text{ etc.}$$

The solution of all these forms will easily be found after some practice has been acquired in the use of the instrument, and it is, therefore, quite sufficient to give one example only in relation to them :

Example : $\sqrt{\frac{12.1 \times 24.7}{37.1}} = 2.838.$

Solution : 37.1 on first or second upper slide scale is set so 12.1 on first or second upper rule scale, then the runner is set to 24.7 on second upper slide scale, and the result read off at index of runner on lower rule scale.

Trigonometrical Computations.

In order to find sines and tangents the slide is taken out of the rule, turned around, replaced bottom side up, and its two ends set so as to coincide with the ends of the rule, as shown in fig. 5. Now, the sine is found by looking up the

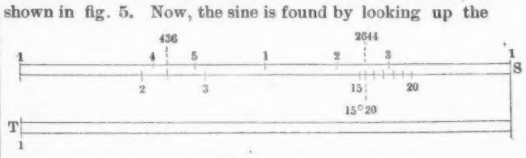


Fig. 5.

angle on the upper graduation of the slide marked S, and reading the figure opposite it on the upper graduation of the rule, the characteristic of the sines in the first scale being 0, and of those in the second scale —1. The tangent is found by looking up the angle on the lower graduation of the slide marked T, and reading the figure opposite it on the lower

graduation of the rule, the characteristic of all tangents contained in this scale being 0; thus we find for example:

sine 3° = 0.0523 first scale.
sine 15° 10′ = 0.262 second scale.
tang. 25° = 0 466.

Multiplication and division of sines as well as tangents are executed in the same manner as ordinary multiplications and divisions, employing, of course, the upper scale for the sines and the lower one for the tangents.

For example, $45 \times \sin 3° 40' = 2.875$.

The left or right index of upper slide scale is set to 45 on upper rule scale and the result read off on the same opposite 3° 40′ on upper slide scale.

Again

$$\frac{565}{\text{tang } 14° 30'} = 2183.0$$

14° 30′ on lower slide scale is set to 565 on lower rule scale and the result read off on the same opposite left index.

The tangents are found direct only as far up as tang 45°. If operations have to be performed with tangents of larger angles, then

$$\frac{1}{\text{tang } (90 - \alpha)} = \text{tang } \alpha$$

is introduced, thus transforming a multiplication into a division and vice versa.

For example:

$$175 \text{ tang } 75° 15' = \frac{175}{\text{tang } 14° 45'} = 665$$

14° 45′ on lower slide scale is set to 175 on lower rule scale, and the result read off on the same opposite right slide index.

It is easy to see how more complicated trigonometrical problems can be solved by the slide rule. For example: Given the three angles of a triangle and one side: $\alpha = 35°$, $\beta = 33°$, $\gamma = 112°$, $a = 155'$; sought

$$b = \text{sine } 33° \frac{155}{\text{sine } 35°} = 147.2$$

35 on upper slide scale is set to 155 in first or second upper scale, and the result read off on same scale opposite 33° on upper slide scale.

The sines of an angle can also be found without reversing the slide, by setting the angle on the scale marked *S* to the index line in the opening on the bottom side of the rule; then the sine of such angle can be read off on the upper slide scale opposite the third rule index.

For example, sin 16° = 0.275, 16° on the upper scale of bottom side of slide is set to the index mark in the opening on bottom side of rule and then the sine is read off on upper slide scale opposite third index of rule. The square of this sine is found without changing the position of the slide, by reading it off on upper slide scale opposite 0.275 on upper rule scale, $\sin^2 16° = 0.0756$.

It is evident that by this operation the value $0.275 \times 0.275 = \sin^2 16°$ has been formed.

Finally, it should be mentioned that logarithms of numbers can be found by means of the centre scale contained on the bottom side of slide. To find, for instance, log. 5 the left index of the slide is set to 5 on lower rule scale, the instrument is then turned around and the logarithm sought for read off on the centre scale of slide opposite the index mark pertaining to it.

The Gold System of Continuous Heating.

The accompanying diagram shows the arrangement of the pipes, traps, etc., of the Gold system of continuous heating as applied on the Lehigh Valley.

This system has been so fully illustrated and described in these columns* that any further description of the general system is hardly necessary.

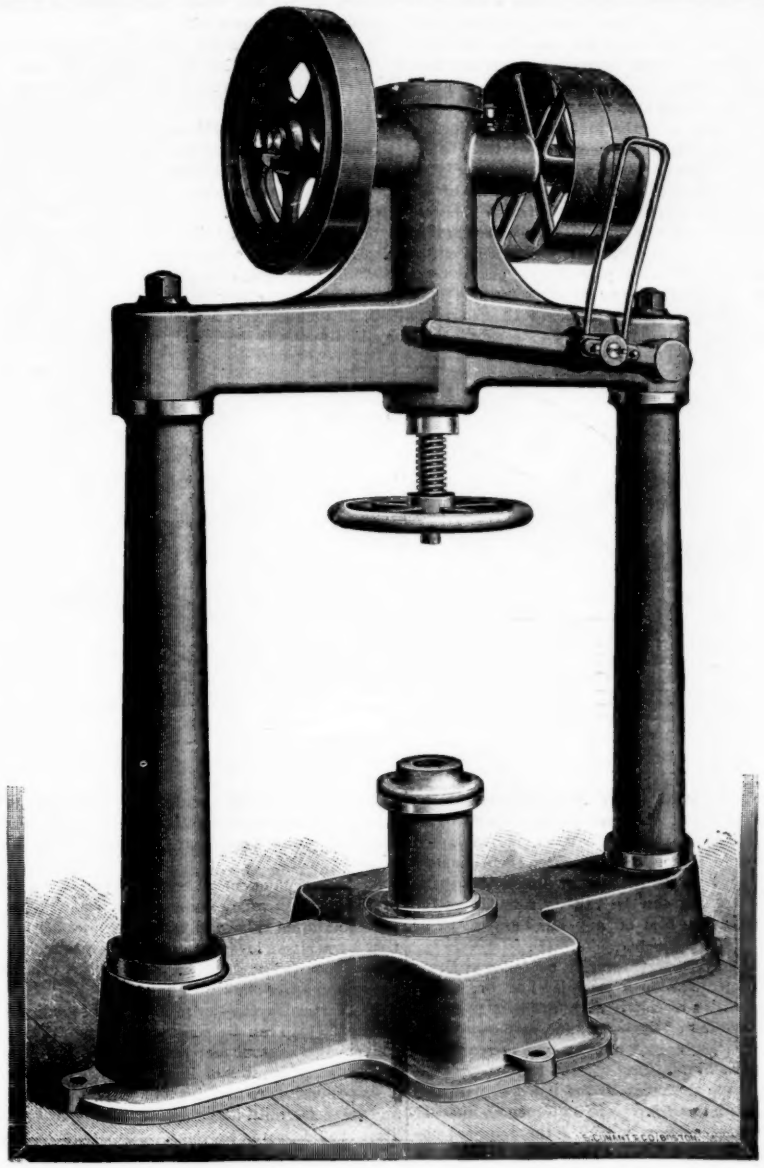
One of the most essential features of the Gold system is the storage of heat provided by large pipes partially filled with salt water and surrounded by a jacket of steam. The body of salt water acts as a reservoir of heat, and when the engine is detached, the heated water radiates heat to the surrounding steam; which in turn continues to radiate heat throughout the car. It is also evident that the steam being then kept warm, cannot condense so quickly as it would were no body of hot water present.

The weight of salt water contained in the car illustrated is estimated at 363 lbs., and as the car contains only 2,780 cu. ft., or 58 lbs. weight of air, it is calculated that the salt water in cooling would warm to a comfortable temperature over 20 times the value of air contained in the car. The amount of radiation from the car itself varies considerably, and no very definite result can be predicted from the calculation as to the time during which the car can be kept warm by the heat contained in the salt water. Actual practice has, however, shown that a car can be kept warm for from 3 to 6 hours, according to circumstances. It is also found that even when the salt water freezes that no damage is done, the ice simply expanding and filling the pipe without bursting it.

Mandrel Forcing Machine.

This machine is designed to be used in forcing mandrels into work of all kinds; also for driving mandrels out of the work. Both screw and hydraulic presses have been largely used for this purpose, but the machine illustrated performs its work in a novel manner.

The forcing is done by short, quick blows of the ram; the hand wheel and screw, shown in the illustration, being used to follow the mandrel as it is being driven into the work. The ram has a movement of only ¼ in., but makes from 175 to 200 strokes per minute, and from the nature of the blow



MANDREL FORCING MACHINE.

Made by the WALKER MFG. CO., *Cleveland, O.*

is exceedingly powerful. When the machine is in operation one man cannot follow the mandrel with the hand wheel as fast as the ram will drive it in.

The illustration shows the belt shifter on front of the machine, but there is also another one on the back of the machine; so that it can be used from either side.

The distance between the uprights is 36 in.; the distance from the base to the end of the ram, at its highest point, 2 ft. 9 in., and the screw in the ram has a travel or feed of 18 in.

Each machine is furnished with three stands for holding the work, 6, 9 and 12 in. high, and four sizes of caps to go on the top of the stand for holding the mandrels. These caps are made of the following sizes: 1¼, 2¼, 3¼ and 4¼ in. hole; and the holes in the stands and the base being 5¼ in., the machine will receive mandrels from 1¼ in. up to 5¼ in. in diameter.

The total weight of the machine is about 1,800 lbs.

Any further information can be obtained of the makers The Walker Manufacturing Co., of Cleveland, Ohio, or of Messrs. Hill, Clarke & Co., of Boston, Mass.

The Use of the Stadia in Railroad Surveying.

BY PROF. J. B. JOHNSON.

III.

REDUCING THE FIELD NOTES.

The reduction of the field notes consists in finding the differences of elevation corresponding to the several distances and vertical angles, and in computing from these the actual elevations above datum of the several points at which the rod was held. This must be done before the work is plotted, and is usually done in the evening, for the day's work. There are many methods in vogue for finding these differences of elevation. There are a number of tables which may be used, and also graphical methods.

The equation giving the difference of elevation in terms of the stadia reading of the distance, and the vertical angle, the rod being held vertical, is:

$$h = \tfrac{1}{2} r \sin 2v + (f + c) \sin v \qquad (1)$$

The true horizontal distance in terms of the distance read on the stadia rod, and the vertical angle, is:

$$d = r \cos^2 v + (c + f) \cos v, \qquad (2)$$

where:

h = difference of elevation.
d = true horizontal distance.
r = distance read on rod.
v = vertical angle.
f = focal length of objective.
c = distance from objective to centre of instrument.

If tables are to be used for obtaining these results, the most convenient and suitable for this work are those of Mr. Arthur Winslow, computed for the geological survey of Pennsylvania and republished in various places.* The greatest objection to the use of tables is that a multiplication is required for every result, the tables giving the elevation for a distance of 100 ft.

The most convenient method of doing this part of the work is by a diagram. There are a number of these also, some of which require entering twice to obtain the result. Two very convenient diagrams have recently been described and small diagrams shown, which could be constructed for use on a large scale.† The writer also has published a large diagram, 20 × 24 in., printed on heavy lithograph paper from a carefully engraved plate, giving elevations readily to the nearest tenth of a foot for distances to 1,500 ft. and elevations to 50 ft.‡ The diagrams give results quite as accurate as the tables, and are very much more rapid. The observer and his recorder work together, one using the diagram and the other the note book. A day's work can thus be readily worked up and the final elevations obtained in one evening. The plotting should be done in the day time, and one member of the party should be detailed for this service.

The recorder in the field should plot his own notes the following day. Usually the topographer and the leveler could rotate in recording and plotting, leaving the level in the hands of the rodman, and taking another man for rodman. The leveling is now easy work, since only the hubs (⊙'s and ⊡'s) are to be taken, with no profile or side readings.

The particular methods of arranging the notes, the computed differences of elevation, and the final elevations, were shown in the previous article. (See issue of March 2, p. 134.) If the final elevations of the ⊡'s and ⊙'s do not agree with the elevations found by level, the latter are taken, and then the elevations of all the side readings found. The readings on ⊡'s are therefore reduced first to see if the elevations by stadia and by level agree. If not, and there should be a uniform difference which could be explained by an assumed

* See *Railroad Gazette*, Nov. 19, 1886, and June 17, 1887. The Gold system as applied to the Baker is shown in the issue of Dec. 16, 1887.

* These tables are given in Theory and Practice of Surveying, by the writer. Wiley & Sons: New York.

† See School of Mines *Quarterly*, July, 1886, by Bailey Willis, and *Engineering News*, March 19, 1887, by Prof. I. O. Baker.

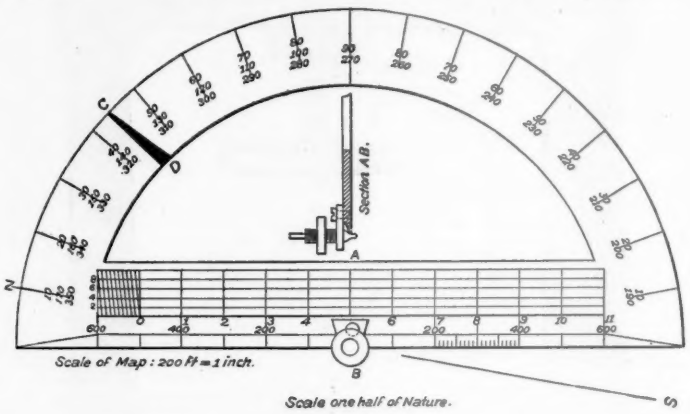
‡ To be had of the writer, Washington University, St. Louis, Mo., price fifty cents, post-paid.

index error in the vertical circle readings, then a correction is found, which, if large enough to warrant it, is applied to all the vertical angles on side readings, and then the differences of elevation are taken for these corrected angles, and their final elevations determined.

PLOTTING THE WORK.

It is customary to first plot the main line of stations to obtain a check, if possible, on the accuracy of these before the side readings are plotted. Such a check can usually be obtained by the section lines in the newer portions of the United States, and hence all such lines, when crossed, should be taken by holding the rod at two points in each such line, or at a corner, if one should fall within the surveyed belt.

Having now the line of stations plotted and checked, the side readings are plotted by means of a protractor. The most convenient protractor for this purpose is that shown in the accompanying figure.



This protractor, graduated to 30′ is for plotting to the scale of 200 ft. to the inch. The graduation on the straight-edge should be suited to the scale to be used. It is adapted to both compass bearings and to azimuths read continuously around to 360°. By it both the bearing, or direction, and the distance of a side reading can be rapidly found, and the point plotted without the aid of any auxiliary scale or dividers.

The method of using this protractor is as follows: Draw through each instrument station a meridian line, or, better, two short pieces of such a meridian at a distance from the station equal to the radius of the protractor, as shown in the figure. Suppose we wish to plot a point whose reading is either N. 10° W. or S. 10° E. Having centered the protractor at the station, swing it around to the position shown in the cut, and then, with the sharp point of a pencil, indicate its position on the map, corresponding to the required distance, as shown on the record. The protractor here shown is supposed to have a 4-in. radius, and when graduated for 200 ft. to the inch, a distance of 600 ft. could be directly plotted in any direction from the station. If continuous azimuth readings were used to 360°, instead of the compass bearings, then the reading would have been either 170° or 350°. A distance of 600 ft. would include nearly all readings taken on a railroad survey. If greater distances need to be plotted, they could be done in the usual manner, with the aid of an auxiliary scale or by a pair of dividers, and the scale of equal parts shown on the protractor itself. One soon becomes very quick in the use of this protractor, so that the side readings can be plotted nearly as fast as the assistant can read them from the note book. It will be found economical, therefore, to provide a helper for this purpose. This protractor has been used on the Mississippi River Survey and on the practice surveys by the engineering students of Washington University, and has given great satisfaction. It is not, I believe, a listed article in any manufacturer's catalogue, but must be made to order.

As each point is plotted, its elevation is noted with a sharp 6 H pencil, in small figures, and also its designation, if this be important. Thus, if it be the corner of a house, the house could be immediately drawn on the map. If it be the bank of a stream, the letter *S* might serve to indicate it, and so on. The important consideration being, that when all the points are plotted each one should indicate some particular fact to the draughtsman, who is now charged with sketching in the contours and the natural and artificial features.

DRAWING THE CONTOUR LINES.

The contour lines give to the map its principal value, and they are the most difficult to obtain. Some experience and a natural faculty for remembering the *appearance* of the ground is essential to a true representation of this ground on paper. The sketches in the note-book may be made to assist greatly in drawing the contours, but the draughtsman, who should be the man who took the notes, should be able to recall *a very vivid mental picture* of all parts of the ground worked over. If he cannot do this he should carry the map into the field, after the points are plotted, and sketch in the contours while on the ground. If the engineer has the proper vividness of perception, however, and has had some experience, he will be able to do this part of the work very correctly indeed without going back to the ground. In any case, the true geometric significance of a contour line must be kept constantly in mind. Thus, he should have, as a sort of instinctive basis of action, the following principles ever before him:

1. All points in the same contour line have the same elevation above datum.

2. Where ground is uniformly sloping, the contours are equally spaced, and where the surface is a plane they are also straight and parallel.

3. Contour lines never intersect or cross each other.

4. Every contour line must either close upon itself or extend continuously across the sheet, disappearing at the limits of the drawing.

5. No contour should ever be drawn directly across a stream or ravine. It comes to the bank, turns up stream and disappears in the outer stream line. In the case of a ravine, the crossing may be shown if points have been established in the bed of the ravine.

6. Where a contour closes upon itself, the included area is either a hilltop, or a depression without outlet. If the latter, it would in general be a pond or lake. In other words, such contours inclose either maximum or minimum points.

7. If a higher elevation on the plot seems to be surrounded by lower ones, it is probably a summit, but if a lower elevation seems to be surrounded by higher ones, it is probably a ravine or else an error, otherwise it is a depression without outlet, in which case there would probably be a pool of water shown.

8. Contour lines cut all lines of steepest declivity, as well as all ridge and valley lines at right angles.

9. Maximum ridge and valley contours must go in pairs, that is, no single lower contour can intervene between two higher ones and no single higher contour can intervene between two lower ones.

10. Vertical sections or profiles corresponding to any line across the map can be constructed from the contours and conversely a contour map may be drawn from the profiles of a sufficient number of lines.

The contours are first drawn lightly in pencil, and erased and corrected until they satisfactorily represent the surface They should then be inked in. The most convenient method of obtaining a perfectly uniform line is probably to draw it with a right line pen held freely in a vertical position in the hand. Before drawing the contours, the stream and valley lines should be sketched in, even to the smaller ravines and gullies, and also the general position of the ridge lines located. These will then furnish an excellent skeleton, on which to hang the contours, by the aid of the elevations already plotted. Having drawn the contours, put in the streams, and other natural features, the section lines, fences and houses, if preferred, and indicate the character of the surface, as cultivated, woods, prairie, rocks, etc. The map is now ready for the study for the location.

The office methods of selecting any desired location from a contour map, and the field methods that may be used in transferring this located line to the ground, will form the subject of the next article.

The Cyclone Oil Burner.

The accompanying engraving represents an apparatus for burning petroleum under locomotive or other boiler. It is well known that in order to secure perfect combustion, the oil must be supplied in an atomized or finely divided state. The opening for discharge of oil has to be so small that regulation of the area by a spindle is almost impracticable, and an annular oil opening surrounding a steam nozzle is even more delicate. Therefore a jet cannot be used to scatter the oil or regulate the amount of oil so as to influence the size of flame.

In the burner under notice, the scattering or atomizing is effected by passing the oil under pressure through a tube containing a screw blade so that the discharge from the nozzle is gyratory. Through this action, centrifugal force comes into play, and the oil issues in the form of a spray cone of such infinitesimal small drops as to resemble vapor, so that this nozzle may well be called an atomizing nozzle.

Surrounding the oil tube, as above described, is an annular passage, which also contains a screw blade, so that the air which is drawn or forced through likewise takes a gyratory motion, and it, like the oil, maintaining this motion on issuing and mixing with the oil, forms into a spreading cone. While this gyratory motion of the air retards forward movement, its speed is maintained, the flame is held close to the burner and the volume of the flame increases rapidly.

The following is a description of the burner:

A is the attachment for the oil; *B*, air inlet (open, or for pressure supply); *C* is the discharge nozzle for the oil, containing a screw blade; *D* is the discharge end, and *E* is a slide which controls an auxiliary inlet through which additional air is induced by the action from the central air and oil discharge.

To provide against a stoppage by dirt, each burner is fitted in the end of the oil tube with a strainer *F*. After taking off the cap *G* the strainer *F* can also be cleaned out, or the whole tube can be readily removed, and the spray nozzle *C* examined by unscrewing and taking apart.

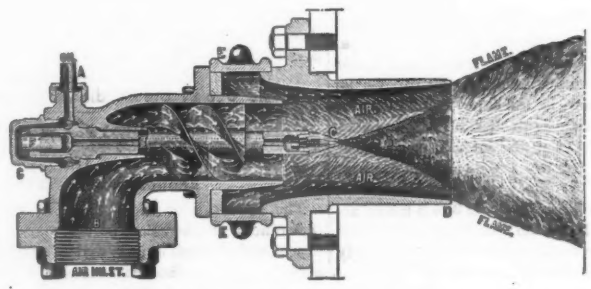
The oil is intended to be supplied at a pressure of about 35 lbs. per sq. in. The oil is supplied at a higher pressure by a small pump, and the supply is regulated by a throttle valve, which reduces the pressure and quantity of oil. The air may be supplied at a low pressure, 1 to 3 oz., by a steam jet blower or an ordinary fan, but in many cases the air can be used at ordinary atmospheric pressure.

The quantity of the blast is not intended as a supply for combustion. It need be but sufficient for ignition, while a somewhat larger volume is not harmful. This feature is very desirable, as the same size of pipe and the same quantity of blast answer for larger or smaller quantities of oil, while the balance of the air which is required for combustion is admitted through the doors or grates, or through openings specially provided for the purpose where furnaces are fitted for oil burning only.

The numerous devices in furnace construction, as second combustion chambers, providing for hot air admission, and all improvements leading to perfect combustion or to maintain flame through long passages, apply with advantage to the burning of oil, equally as with coal firing.

The location of the burner depends entirely on the form of the furnace and the convenience with which it can be attached and operated. It may be fixed horizontally or at an angle with the direction of the flame, and through the front, the back, or the side walls. A favorable direction of the flame is readily arranged through flues, as under cylinder boilers, in heating furnaces, and under evaporating pans. Where, however, the fire-box is short, as is the case in the boilers of the locomotive or upright tubular type, it may be found desirable to direct the flame against a bank of fire-brick for better distribution.

Any further particulars can be obtained of the makers, Messrs. L. Schutte & Co., Philadelphia.



THE CYCLONE OIL BURNER.

Made by MESSRS. L. SCHUTTE & CO., *Philadelphia.*

Heavy Planer and Smoother.

The machine represented in the accompanying engraving is made by the Egan Co., of Cincinnati, and is described by the makers as a No. 4 heavy planer and smoother, with pressure bars on each side of knives and concentric to them. It has also four 6-in. rolls, all geared.

The makers state that the demand for something better in the way of a hardwood planer and smoother than has heretofore been produced has resulted in the machine shown by the above engraving, and it is said that woodworkers who have been looking for a machine capable of doing extra fine work will not be disappointed in the performance of this planer.

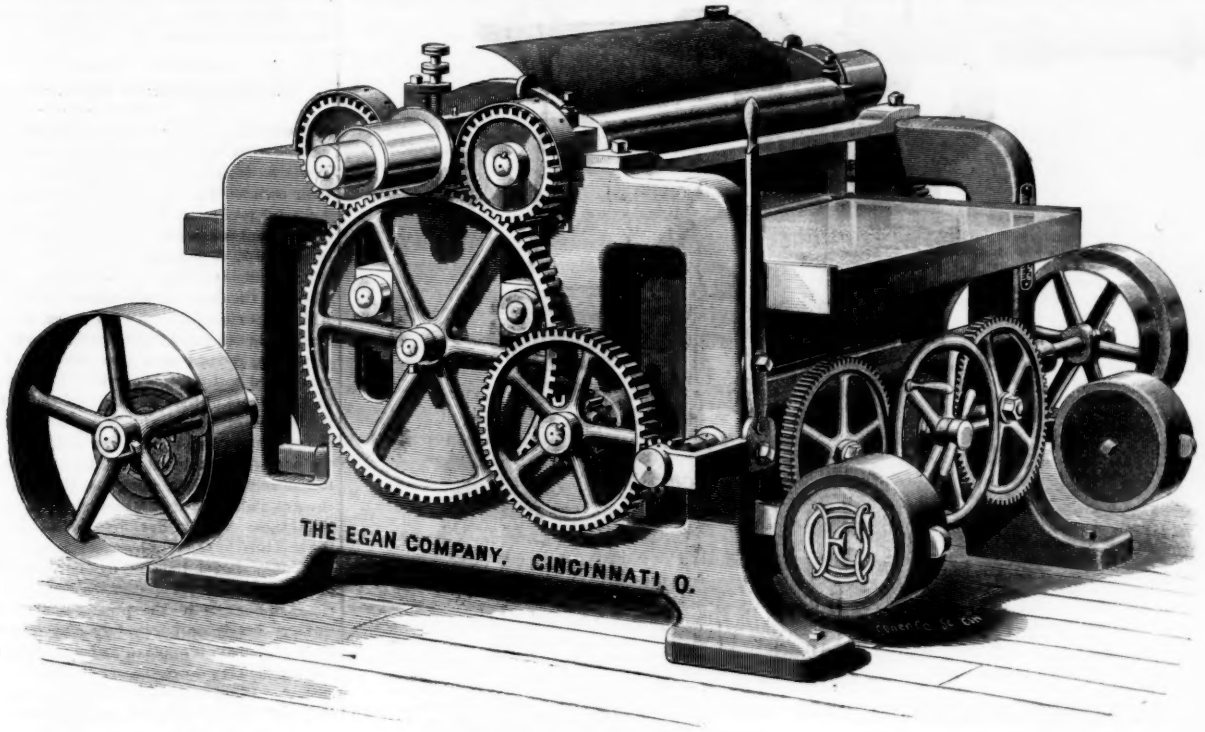
It is claimed that it is constructed on an improved principle and in such a manner as to combine strength and solidity, two great factors which tend to make a perfect smoother.

The frame is cored and substantially braced, making it stiff and suitable for a machine of this class.

The table is dovetailed in the frame and raises and lowers on long inclines by means of two screws operated by a hand-wheel convenient to the operator. This means of adjusting the bed is acknowledged to be the best known, as it makes the bed absolutely solid and free from vibration, as the bed has more support beneath it than can be obtained in any other way.

The feed consists of four powerfully geared feed rolls, 6 in. in diameter, making a feed that, it is stated, can be relied upon as being first-class in every particular.

The feed rolls are weighted on an improved principle, the



HEAVY PLANER AND SMOOTHER.

Made by THE EGAN CO., *Cincinnati.*

weights being adjustable to give more or less pressure as desired. There are two speeds to the feed, and the makers claim that this machine will do smoother work at its fastest feed than has heretofore been attained on any other smoothing planer at a much slower speed.

The cylinder is four-sided, so as to use either two or four knives, as may be desired. It is double belted, and the feed is run directly from it. There are pressure bars on each side of the cylinder, arranged on a new principle, and work to the circle of the head, thus preventing all tearing out of wavy grained or knotty stuff, either narrow or wide, or clipping of ends, which is so common with many smoothing planers.

This machine is made of different sizes, 24, 26, 28, 30 and and 36 in. wide. The cut shows a 30 in. machine, and each size is built in proportion.

One of the greatest advantages of this machine, specially in the wide sizes, is that the stock can be run *diagonally under the cylinder*, which is far better than running a cylinder in a diagonal position, as it permits straight belts being run to the cylinder, and the planing of short stuff. It is specially adapted for planing framed stock where straight and cross-grained wood is built up.

For further information and prices address the manufacturers, The Egan Company, Cincinnati, O.

The Timms Journal Box.

The accompanying illustration represents an improved form of journal box that has been used successfully on both freight and passenger service during the last three years. It is claimed that it secures the highest conditions favorable to economic results in the use of oil and waste, metal bearings and axle journals.

The three elements in its construction that accomplish these results are dust guard, end stop and close lid.

The dust guard is made of sycamore wood, and is either in one or two parts; either as a whole, or in two parts by being cut across at middle of the opening through which the axle passes. It has three plane surfaces. Two upon the side towards the chamber of the box, forming two inclined planes, rising at the middle to the height of 1 in. from the third plane next to the wheel. These inclined planes serve to carry the oil upon axle back towards the centre of the box; and it is claimed that no oil will run out upon the road or upon the wheels when the car is in motion, and unless the box is filled to overflowing no oil will ever be wasted by the use of the box, and that no dust or sand can enter the box.

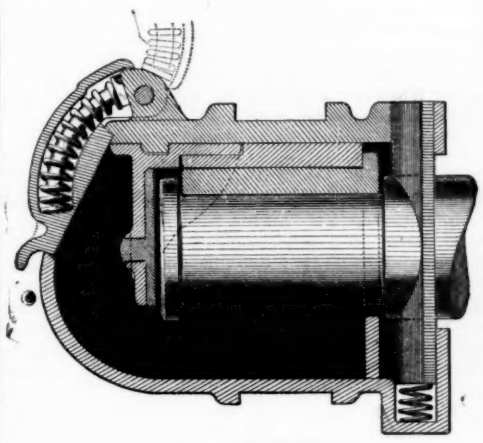
Sycamore is found to wear well and so effectually preserves the oil from waste that freight cars have been run for six months, making something like 15,000 miles, with but the first oiling.

The end stop provides against an undue lateral motion of the axle when in motion. Its service is similar to that of the Bissel wedge used on the Pullman cars. The Timms, however, covers the entire end of the axle, while the Bissel wedge covers not quite half of the end of the axle, and consequently presents less bearing surface and it is claimed is more liable to cut and heat.

The Timms wedge or end stop being in two parts, can be put through a smaller doorway than can the Bissel wedge. It is claimed that this wedge has never failed and is so effectual that bearing metals have been in almost constant service on coal cars for a term of two years and four months, and then when taken off for examination have been found capable for many years more service. This end stop is readily applied to the standard M. C. B. journal box.

The end stop is made of gray iron faced or chilled or brass lined on the inner part which comes in contact with the end of the axle. The end stop is made separate from the key, and is held in place by the lug in the top of the box, which holds the common key in place. The key also helps to hold the end stop in place, and it can only be removed when the box is jacked up to relieve it of the weight of the car. The end stop can be put into the same doorway that now exists in the M. C. B. box, and at the same time cover the entire end of the axle. If the end stop was fast to the key [and made to cover the entire end of axle, it would necessitate the bottom of the doorway being cut down below a line with the bottom of the journal in order to get the end stop in position. This would be a serious disadvantage, and as now constructed the bottom of the doorway is retained level with the centre of the journal.

The lid fits closely, and it is claimed that it is free from looseness, jar and rattle, and secures the chambers of the box from dust and sand.



The Timms Journal Box.

The spring in the lid which serves to close it has a direct pressure from the lug on the top of the box where the lid is hinged to the lower part of the lid, which is consequently held tightest when closed. No clamp is required to place the lid in position or remove it. The lid is not planed or filed.

The following figures as to the performance of this box are extracted from testimonials:

Railroad.	Service.	Miles per gallon of oil per car.	Loss of brass per car per 1,000 miles.	Journal box.
Cincinnati, Wash. & Baltimore.	Pass.	443	.....	M. C. B.
		1,728	Under 2 oz.	Timms.
Pittsburgh, Cin. & St. Louis.	Cabin car	.....	3.5 oz.	M. C. B.
		.....	0.8 oz.	Timms.
Cincinnati, Wash. & Baltimore.....	.....	8,000	1.6 oz.	Timms.
Do.....	Tender.	.....	6.95 oz.	M. C. B.
		.....	2.84 oz.	Timms.

All the testimonials concur in stating that the riding of the cars have been much improved by the use of the Timms box. The extra wearing surface of the end stop doubtless prevents undue end wear of the bearing, and thus checks side oscillations.

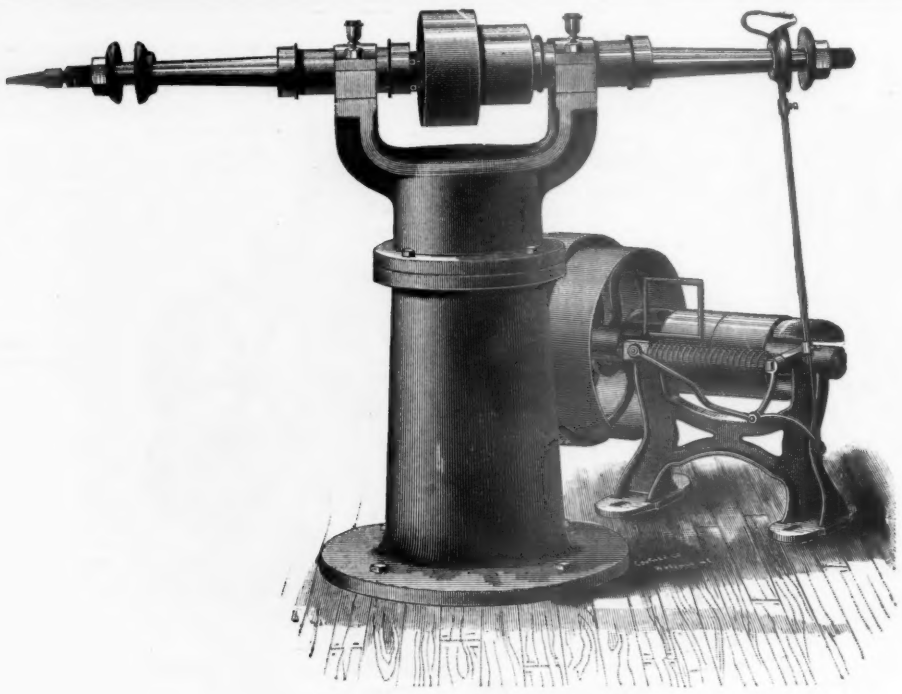
It is stated that the wear on the end stops of a coach running between Columbus and Indianapolis for two years has not exceeded $\frac{1}{16}$ in.

Any further information may be obtained of the Timms Car Coupler & Journal Box Co., Columbus, Ohio.

The Chicago, Burlington & Quincy Strike.

The striking engineers and firemen of the Chicago, Burlington & Quincy are still "out," and the officers of the Brotherhoods have stated that they will allow the organizations to go to pieces rather than yield. The road has steadily increased its train service and now has nearly or quite all its passenger trains running, as well as most of the local and many through freights. The newspapers give no reports of any serious dissatisfaction among shippers of through freight or of local either, for that matter. The strikers have made numerous assertions concerning the incompetence of the new runners, alleging the burning of boilers and other reckless conduct, and have caused complaint to be made to the state authorities in Iowa, demanding that an investigation be made. General Manager Stone issued to his division superintendents and published in the papers a conciliatory letter, stating that the road had, out of consideration for its old men, moved as slowly as possible in employing new men and calling on individuals to act independently and return to their places. While the company would of necessity fight to the end, the division superintendents were directed to exert themselves personally to persuade the men to return. Neither this letter nor the notice issued last week limiting the time in which the men might return had any effect. The enginemen on the St. Louis Bridge & Tunnel road and on the Wabash refuse to haul Burlington trains. On several other roads enginemen have refused to haul cars claimed to contain Burlington freight. On the St. Louis bridge the Master Mechanic handled the Burlington trains himself, and on the Wabash, between St. Louis and St. Peters, Burlington trains were discontinued. At Streator the enginemen of other roads would not run to the coal mines on the Burlington until they had got leave from Mr. Arthur. At Quincy a coal company was notified not to furnish coal to the Burlington on pain of having its cars boycotted on other roads.

On Saturday Chief Arthur issued a call for a conference of committeemen of all the roads entering Chicago, and it was reported that a strike would be ordered on most of the roads, on the alleged ground that these roads had given aid and sympathy to the Burlington. So far as can be learned, this conference, extending through Monday and Tuesday, resulted in nothing aggressive. A large meeting of the Brotherhood was held in New York city on Sunday, which passed resolutions recommending that the strike be extended over the whole country on March 30. The Chicago, Burlington & Northern enginemen voted on Sunday to strike at 7 p. m. on Monday; a conference was had with General Manager Harris, which averted the threatened action for a time, but on Wednesday the men left. Their places were filled without much trouble, the business being light. Mr. Arthur sent word last week to the Brotherhood men on the Philadelphia & Reading to resign their places, so that the Knights of Labor who had been displaced there could get their positions back. This action was taken apparently in pursuance of an agreement with the leaders of the Knights looking to the withdrawal from the Burlington of the men who have just come there from Pennsylvania. But, so far as can be learned, this scheme was a complete failure, the officers of the Knights apparently having little influence with their men; though it is reported that a considerable number



HEAVY BUFFING LATHE ON PEDESTAL.

Made by the SPRINGFIELD GLUE & EMERY WHEEL CO., *Springfield, Mass.*

of individuals who went to work on the Burlington have, for one cause or another, resigned, some of them returning East. The Brotherhood men work industriously to persuade new men to leave, and have been in some cases ordered off the road's premises. Officers of the road say that a number of the alleged desertions are simply those who could not pass the strict examination; and they have denied many of the reports about damaged engines. There have been few or no reports of active sympathy with the strikers on the part of other Burlington train men except the case of one conductor at Aurora who was suspended for refusing to pilot a new engineer over the road.

Mr. Arthur has issued another manifesto giving some comparisons of rates on the Burlington, on the Alton and on the Northwestern. These comparisons show rates on the Burlington which are not nearly so high as those cited by Mr. Stone in his statement published last week, but it is impossible to make an intelligent comparison of the whole question from the published statements of either side, as each gives only a partial list. The averages quoted by the General Managers in their open letter are not conclusive, as no statement is made concerning the number of trips made. When freight traffic is heavy enginemen run a considerable percentage of extra trips and earn ten or twenty per cent. higher pay, and even more, without hardship. We read recently of a western road where some of the men received 50 days' pay in a single month. An average, to be enlightening, should be based on 26 or 27 trips per month. The present schedule of the Burlington shows that an old freight runner between Galesburg and Aurora, 125 miles, earns 4.2 cents per mile and a passenger runner 3 cents. From Galesburg to Quincy, 100 miles, passenger runners receive more per mile (3.5 cents) while the freight men get less (3.6 cents). From Aurora to Chicago and return, 38½ miles each way, passenger men receive 4.35 cents and freight 4.50 cents per mile. On the light passenger runs like those quoted in the managers' letter, advantage seems to have been taken of an unusually long run made in exceptionally favorable hours to keep the rate per mile below the average. On the run from Vermont to Buda and return, which Mr. Stone refers to, the engineer earns $4.75 per day, but he has to run 189 miles to do it, making the rate per mile only 2½ cents. The general aim seems to have been to pay on the short runs enough more per mile to bring the wages per day up to somewhere near the average, while the long easy, runs were reduced for the same purpose; but the Quincy-Galesburg freight run would seem to constitute a marked deviation from this. The enginemen evidently want the short run rates raised to a point which shall make these the most desirable runs, and it is said that one of their grievances is that some of the older men have been taken off from hard main line runs and retired to the branches because of their age.

The rates for the first year are generally from 90 cents to $1.10 per trip less than the full rate, and about one half this difference is added at the beginning of the second year. What proportion there are of first-year and second-year men does not appear.

WAGES QUESTIONS ON OTHER ROADS.

A telegram from Albuquerque, N. M., March 2, states that the conductors and brakemen on the Atlantic & Pacific had struck, because additional yard work had been imposed upon them by the new superintendent, causing a complete suspension of business. A later dispatch reported that the matter had been settled.

A Kansas City dispatch of March 3 states that the Kansas City, Ft. Scott & Gulf road has granted the demand of its enginemen for an increase of wages to the following rates: Passenger engineers, 3½ cents per mile; freight, 4 cents; local freights, 4¼ cents.

Reports concerning applications for increase of wages by men of various grades on the Pennsylvania have been in circulation for some time, the matter in several cases being apparently still unsettled. A Pittsburgh paper, however, states that a slight increase has been granted to all the conductors and brakemen on the Pittsburgh, Fort Wayne & Chicago, and its branches west of Alliance. Conductors are raised from $2.85 to $2.95 per trip; brakemen from $1.80 to $1.90, and flagmen (rear brakemen) $1.90 to $2. There is no increase on the division between Alliance and Pittsburgh, but more favorable rules concerning overtime have been established.

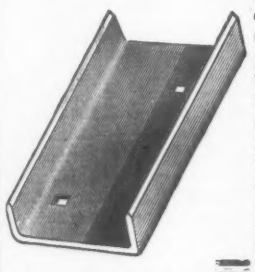
Heavy Buffing Lathe on Pedestal.

This machine is designed as a heavy, strong, durable tool, and weighs about 450 lbs. The spindle is 48 in. long, giving ample room to handle large pieces in any position and clear the frame. A ¾-in. hole is tapped out at each end of spindle for screwing in extra heads, made to carry small emery wheels, felt wheels, walrus wheels, etc. The bearings are 6 in. long, and the spindle is 2 in. dia. in bearings, tapering to 1½ in. at each end where the wheel goes on. The spindle is made with tight and loose collar and nut as shown, or can be turned to any desired taper to hold wheels on by friction. It is also made with tight and loose collars for carrying rolls for grinding out car brasses, circles, curves, etc.

This machine is manufactured by the Springfield Glue & Emery Wheel Co., of Springfield, Mass., from whom any further information can be obtained.

The Servis Tie Plate.

The illustration which we give here shows one form, and probably the best and cheapest form, all things considered, of this device. It is placed lengthwise of the tie, the cutting flanges parallel with the fibres of the wood, and forced down to a continuous bearing on the top of the tie. Another plate, of this same section, is made somewhat narrower, in order that the spikes may be driven outside of the plate, and in still another form the top of the plate projects beyond the flanges. This form, in which the spikes are driven through the holes in the plate, is preferable, in that the inside spike helps to hold the rail in place against the outward thrust. This plate has been in use in the United States and Canada for over three years, and it is said that the results have been very satisfactory. The Chief Engineer of the Fitchburg in 1886, after a two years' trial, said that there was considerable saving, from the use of it, in wear of ties, and that the cost of maintenance would probably be greatly reduced by its application. In the same year the Roadmaster of the Manhattan Elevated wrote of it in similar terms. It was well spoken of also by various railroad officers in Canada, and of the West Shore. The makers write us that they are now filling a large order for the Maine Central and that the Intercolonial of Canada has 100 miles laid with this plate. The advantages claimed for it are too obvious to need mention—that is, that it will save the tie from wear and hold the rail more securely in place than where it is spiked directly to the wood. For soft wood, it would, of course, be especially advantageous, and on curves the additional holding power secured by getting the strain upon both spikes is undoubtedly a decided advantage. The plate is now made by the Dunham Manufacturing Co., 131 Devonshire street, Boston, who are the sole agents for the United States.



The Manufacture of Sewer and Culvert Pipe.

The following notes on the manufacture of sewer and culvert pipe are furnished by Messrs. Blackmer & Post, of St. Louis, as describing in a general way the process followed in their own works. It should be premised that the "dry and wet pan" process as described is new. While the first cost of the plant is considerable, labor is saved and the clay can be tempered very uniformly.

The crude dry clays, in their proper proportion, are first placed in the dry pan, which is so constructed that its bottom, which is perforated with small holes, revolves under two stationary, broad-faced, chilled iron wheels of great weight, the clay being ground to a fine powder. Falling through the perforated bottom, it is carried by a belt elevator in buckets up to the roof of the building, and there emptied into a bin, the bottom of which extends down to the lower floor, directly over the two wet pans. By a slide or door arranged for the purpose, a sufficient quantity of this powdered clay is allowed to run into the wet pans, the solid bottoms of which revolve under two iron wheels; heavy, but of lighter weight than those in the dry pan. Enough water to temper the mixture to the required consistency is added, and by a stationary shovel, handled by one man, the prepared clay is dropped into a hopper, from which another belt elevator carries it in buckets to the press feeder above, by which it is thrown into the open top of the clay cylinder. The cylinder filled, the steam is applied, and the clay follower descends, forcing the clay down the cylinder and through the die at the bottom. When the proper length is run out, the pipe is cut off, and one section of pipe is made, which is then carried away on a truck; or by a convenient elevator it is carried to the floor above, where it is examined, and the rough edges, if any, are trimmed and smoothed. All sizes of pipe are made on one press, a separate die only being required for each size.

When perfectly dry, the pipes are loaded in the kilns, a large slide serving to conduct them directly from the building into the kiln door, the large sizes being first put in place and the smaller sizes inside them, a small space between them only being required to allow the heat and flame to penetrate thoroughly. The burning of pipe is the most critical and scientific part of the whole process of making it. From five to eight days are required to fire each kiln properly, and from 12 to 18 tons of bituminous coal are required for each. First, a small fire is made, and gradually increased until the whole contents of the kiln are at a very high temperature, then the glazing of the pipe is done by the application of a quantity of coarse salt to the burning contents of the kiln. The salt vaporizing by contact with the flame gives the ware, over its entire surface, a coating of glass, making it impervious to the action of moisture or acids of any kind. The burning is now finished, the fires are banked, and the kiln is allowed to cool gradually, from two to five days being required for this purpose, at the end of which time the pipes are ready for the market.

Three qualities of clay are used by Blackmer & Post, mixed by their own formula, a certain proportion of each being required to secure in the finished product a close, hard texture, true shape, smooth surface, uniform color and freedom from cracks and blisters.

Blackmer & Post have just completed and put in operation their extensive new works, occupying 14 acres, in the suburbs of St. Louis. The new buildings contain the largest pipe press in the West, and the improved machinery and arrangements for making and handling pipe developed by their long experience.

London Railroad Stations.

Liverpool street, the London terminus of the Great Eastern, has the greatest traffic of any terminal passenger station, about 800 trains in the 24 hours. This station is being enlarged and will then have six main line tracks leading to it, solely for passenger traffic. The station buildings comprise the general offices of the company; a large hotel fitted with every modern convenience; two large offices for inwards and outward "parcels" (corresponding to our express business); two left luggage offices; four ticket offices; two refreshment rooms opening on the platforms; one dining room upstairs; several lavatories, etc.; one combined barber's shop and dry goods store, where a clean shirt can be procured, or an old hat made to look like new; a fruit and flower store; two book and newspaper stalls, and several minor conveniences. Suitable docks and platforms are provided for shipping horses, carriages, milk and fish, etc., by passenger train. Wherever two offices of a kind are provided they are situated on different platforms and at some distance apart.

The area covered by the station and general offices and hotel is about 13 acres. When the additions are finished the station will have fifteen tracks, two for storage and the remainder alongside platforms. The station being in the heart of London, and space being consequently precious, the trains are made up, cleaned, etc., on sidings some four miles away, and the minimum of switching is done at the terminus. The two main line platforms are each over 1,000 feet long, and the platforms for local traffic average 550 ft. long.

The station is situated a few minutes walk from the Bank of England and is adjoined on two sides by two other busy stations. One, Broad street, the North London terminus, is above ground, and in plan and general arrangement

much resembles its namesake in Philadelphia. The traffic, however, is wholly suburban and consists of some 450 trains in and out every day.

The other station, Bishopsgate, is underground, has about 400 trains every day and communicates with Liverpool street by underground passages, lined with white glazed tiles, and each provided with a ticket office. Passengers arriving in London by a Great Eastern train, can thus take a fresh ticket and proceed at once to any station on the underground or connecting lines without even going out of doors.

The standard suburban train on the Great Eastern consists of 15 vehicles, each 27 ft. to 31 ft. 6 in. long over bodies, and seating either 50 second or third class passengers, or 32 first class. The great bulk of the traffic is third class, and the trains seat fully 600 passengers, or times as many as an ordinary four-car train on the New York elevated railroads. The Great Eastern has no less than 45 passenger and 28 freight stations within the limits of London, many of considerable size, and nearly all are built of brick, with solid stone platforms, iron and glass roofs, comfortable waiting rooms, etc.

Probably a greater number of passenger trains pass through Clapham Junction station than through any one point elsewhere. This station is situated in the southwestern part of London, about six miles from the heart of the city. All the London & Southwestern passenger trains are cleaned and made up here, and the empty trains going to the London terminus, Waterloo, are included in the figures given below:

The average number of trains arriving at and departing from Clapham Junction every week day is upwards of 1,500, of which about 900 are trains belonging to the London & Southwestern and upwards of 500 London & Brighton and South Coast trains, or an average of nearly two passenger trains every minute during 17 hours—from 5 o'clock in the morning to midnight. Several trains of the London & Northwestern, the London, Chatham & Dover, the Great Western and the Great Northern companies also pass through the station.

The Junction is primarily formed by two four-track roads uniting in one six-track road, with a three-track road running alongside, and several secondary spurs and branches. The station has been recently enlarged and now covers over 23 acres. The various ticket offices are all situated in a large, well lighted tunnel, running right across the station at right angles to the nine parallel platforms. The waiting rooms, urinals and water closets, book and newspaper stalls and refreshment rooms, etc., are situated on the platforms. This station forms an exchange point, and any passenger arriving there from the country can alight and take his choice of trains running to three of the principal terminal stations and to about 150 different stations in the suburbs without further change of cars.

Trunk Line Joint Bureau of Inspection and Weighing.

Among the provisions of the agreement under which the Trunk Line Joint Committee's Inspection Bureau is formed are the following:

That the system of inspection be first applied to eastward traffic, as the larger and more important; but that it be extended to westward as soon as practicable. * * Inspectors be located in the offices of the western roads terminating at the western termini of the Trunk Lines. * * The Trunk Lines not to receive any traffic from western connections except as approved by the inspectors. Inspectors report corrections to the agent of the delivering lines at his station; it shall be the duty of such agents to make all corrections required by the inspectors, to notify their western connections thereof, and in case any question arises to hold the property until the corrections are accepted. * *

If any western roads which are not members of the Joint Committee decline to permit the Inspectors to perform the aforesaid duties, the trunk lines via which the freight is routed shall, in case corrections are necessary, decline to receive the freight until such corrections are made and accepted by their next western connections. The Inspectors shall weigh all freight, including live stock, not way-billed as having been previously actually weighed at starting points or en route, and which it is not agreed shall be weighed at points of destination; except flour in barrels or other freights classified to be charged at estimated weights. * * All the carriers to share in corrected weights and rates.

Beginning with the date on which this system of inspection goes into effect, all freight will be received by the roads in the Committee, subject to the rules of inspection and weighing; the freight will not be received from delivering lines when not way-billed in accordance with the proper tariff, divisions, weights and classifications as from time to time issued or authorized by the Joint Committee or by the Central Traffic Association. The new system will be put in effect at once.

TECHNICAL.

Locomotive Building.

Thirteen new locomotives will soon be received by the Southern Pacific Co. Three of them were built in Rhode Island and the other ten in New York. They will be used on the Salt Lake Division of the Central Pacific.

Ten locomotives for the Northern Pacific have been turned out at the Brooks Locomotive Works.

The Louisville & Nashville will soon put 25 new locomotives in use.

The Georgia Pacific has recently placed orders for 6 new locomotives.

The Nashville & West Nashville Railway, Nashville, Tenn., asks bids for dummy engines, rails, etc.

The Brooks Locomotive Works has just completed 10 locomotives for the Union Pacific. A like number has been built by the New York Locomotive Works, and the Providence Locomotive Works is also building 10 locomotives for this road.

Car Notes.

The Cincinnati, Hamilton & Dayton has ordered 12 more passenger cars from the Ohio Falls Car Works.

The Chattanooga Car Works has received an order for 100 freight cars from the Chattanooga, Rome & Columbus, and 50 coal cars from the Nashville, Chattanooga & St. Louis.

The Barney & Smith Mfg. Co., of Dayton, O., is shipping 25 cars a day to the Southern Pacific. The contract calls for 1,000. They will also soon finish 25 of the 100 cars they are building for the Cincinnati, Hamilton & Dayton, to be used for transporting carriages and furniture.

The San Francisco & North Pacific will soon have added to its equipment 50 new freight cars, 5 passenger cars, and 2 locomotives, one of them a ten-wheeler.

The Anniston shops of the United States Rolling Stock Co are working on a large order from the Columbus & Western.

The St. Charles Car Co., St. Charles, Mo., has shipped the last 3 cars of an order from the St. Louis, Arkansas & Texas. It has also recently made a shipment of box cars for the Atchison, Topeka & Santa Fe, and is now building 50 freight cars for the Kansas City, Memphis & Birmingham. A dividend of 6 per cent has been declared upon the capital stock of the company.

The Indianapolis Car Works have received an order for an additional 100 "warehouse cars" from the Atchison, Topeka & Santa Fe. They are also building 200 34-ft. coal cars for the Cleveland, Columbus, Cincinnati & Indianapolis.

The Marietta & North Georgia has purchased 22 freight cars.

The United States Rolling Stock Co. has awarded the contract for the castings for 250 freight cars to Murray & Stevenson, Anniston, Ala.

The Peninsular Car Co., of Detroit, is building 1,000 freight cars for the Northern Pacific, all of which are to be equipped with the Dunham freight car door.

J. G. Brill & Co., Philadelphia, Pa., have shipped three dummy engines to the Eastlake road.

The Electric Car Co. of America, Wm. Wharton, Jr., President, with offices corner Twenty-fifth street and Washington avenue, Philadelphia, Pa., has the exclusive rights for the United States for street car propulsion under the patents of the Electrical Accumulator Co. of New York.

Bridge Notes.

The Vermont Construction Co., St. Albans, Vt., has received the contract for an iron bridge at Brattleboro, Vt.

The Pittsburgh Bridge Co. has been awarded the contract for an iron bridge across Lytle Creek at Murfreesboro, Tenn.

The contract for building an iron draw-bridge across the Bayou Courtableau at Washington, La., was awarded to the King Iron Bridge Co., Cleveland, O., for $5,600.

The contract for the superstructure of the iron draw-bridge at Walnut street, over Fox River, at Green Bay, Wis., was given to the Lane Bridge & Iron Works, Chicago, at $9,490, and the contract for the substructure was awarded the same firm at $3,979.

The King Iron Bridge & Manufacturing Co. has received the contract for two iron bridges near Raleigh, N. C., for $8,500, and has received the contract for a $3,000 highway bridge at Santa Cruz, Cal.

The Philadelphia Bridge Works of Cofrode & Saylor, Pottstown, Pa., are shipping two iron truss double-track draw-bridges to be used by the Pennsylvania, at Wilmington, Del. One is 198 ft. long and weighs 340 tons, and the other is 252 ft. long and weighs 450 tons.

The new shops of the Pittsburgh Bridge Co., on Thirty-sixth street, Pittsburgh, Pa., are almost completed. When they are put into operation the capacity of the works will be about 67,000 tons.

The King Iron Bridge & Manufacturing Co., of Cleveland, O., have been awarded the contract for the ironwork for two aqueduct bridges for the North Poudre Land & Canal Co., Larimer County, Col. They are both to be combination trusses of the Pratt type, one 80 ft. and one 60 ft. span.

S. A. Oliver & Bro., Houston, Tex., have received the contract for building a $32,000 iron bridge at Vernon, Tex.

The Southern Bridge Works, Avondale, near Birmingham, Ala., has commenced work on a new iron bridge, 250 ft. long in 3 spans, for Village Creek, near Birmingham.

H. F. Stewart, Daytonia, Fla., is interested in a projected bridge to be erected there.

It is stated that a $20,000 bridge will be erected at Mount Morris, N. Y.

The County Commissioners will erect a bridge over the Noxubee River, at Gainsville, Ala.

Bids are asked until March 13 for a 95 ft. iron highway bridge, with a roadway 14 ft. clear, and a capacity 90 lbs. to the square inch. Address Joseph Trudeau, Secretary of the Municipality, Montreal, Can.

The Niagara Bridge Works, Buffalo, N. Y., has completed a wrought iron viaduct bridge for the Colorado Midland over Maroon Creek. It is 600 ft. in length, in ten panels of 30 ft. clear span. The highest towers are 99 ft. high above the stone work.

Manufacturing and Business.

The Washburn & Moen Mfg. Co. has contracted to build 20 miles of fence for the Lehigh Valley in New Jersey, and also for fencing the New Rochester, Hornellsville & Lackawanna 10 miles.

The Indianapolis car-wheel works are to be considerably enlarged.

The Swindell Construction Co., Pittsburgh, Pa., has received a contract from the Syracuse Tube Co., of Syracuse, N. Y., for the erection of a regenerative gas furnace, making three furnaces of this design which they have built for this concern.

Charles A. Schieren & Co. report sales of leather link belting to the Phœnix and the Pencoyd Iron Works, Copeland & Bacon, of New York, and to half a dozen other large manufacturers.

The Non-Magnetic Watch Co. has been organized under the laws of the state of New York with a capital of $500,000, and has purchased the right of the American business of the Geneva Non-Magnetic Watch Co., Limited, and the exclusive right to use the inventions of C. A. Paillard for the United States and Canada. The officers of the new company are: David Ward, President; Louis Franke, Vice-President; H. W. Strauss, Treasurer; A. C. Smith, Secretary and Business Manager. The offices of the new company will be 177 and 179 Broadway.

Bids for five pumping engines, with a capacity each of 15,000,000 gallons of water in 14 hours, are asked for by the City of Chicago, until March 31. One is to be finished by March 31, 1889, and the other four by March 31, 1890.

The Lathrop Co., 82 John street, New York City, has recently sold the New York, Ontario & Western all the valves and fittings for the new steam car-heating system in use on that road.

The Ensign Manufacturing Co., Huntington, W. Va., have received an order for 60 flat and box cars from the Highland Avenue & Belt road.

The East Birmingham Iron Roofing & Corrugating Co. report that they have received orders months ahead, and are doing a fine business.

The Westinghouse Electric Light Co. will commence, in April putting in a plant of their incandescent electric lights for the Fort Worth Light & Power Co., of Fort Worth, Tex.

The Laidlaw & Dunn Co., of Cincinnati, O., has been awarded the contract to supply two Galloway boilers (300 h. p. each) and the pumps to supply the same, for the Electric Lighting Department in Washington Park at the coming Cincinnati Centennial Exposition.

Car Heating Notes.

A trial was recently made on the Erie on a train running from Jersey City to Nyack, under the direction of Mr. R. G. Chase, of the Williames system, using his return system to dispose of the water, in connection with the New York Safety Co.'s system as applied to the Baker heater. In the cars which were piped for the Williames system a circulation was obtained in 11 minutes, and according to the statements of the Erie employés in charge of the heating apparatus in these cars a higher temperature of the pipes was obtained by the use of steam than had ever before been secured by the Baker heater.

A continuous system of heating trains by hot air has been devised by Messrs. W. Berrigan and E. K. Hanley, of Elmira, N. Y. The cold air is pumped by an air pump on the locomotive through pipes in the smoke-box and boiler until it is heated sufficiently. It then passes to the train,—three reservoirs, a pressure gauge, safety valve, a regulating valve and several registers being provided in each car. The system has not yet been fitted to a train, but an application has been made for a patent.

Mr. P. J. Gurnee of Port Emen has invented a "safety car-heater," of the protected Baker heater type. Two steel cylinders are placed one within the other. The space between the two cylinders is filled with asbestos. Within the inner cylinder is a firepot which, with its connecting coal feeder or magazine, has sufficient capacity to burn many hours without a further supply of coal. There are three inner heads, the one over the fire half an inch in thickness. The combustion chamber is bolted against the upper head, while perforated collars allow a draught, and in case of accident keep the redhot coals from escaping. The doors are double, and a small slide can be opened or closed to regulate the fire. The doors are fitted with patent safety latches and padlocks, so that they can be securely fastened. The water is heated in coils of pipe within the inner cylinder and conducted to every part of the car. The whole device weighs about 700 lbs. and is securely riveted in all its parts and bolted to the beams and flooring of the car. It is undergoing trial on the Ulster & Delaware, and the results thus far have been satisfactory.

It is reported that the Indianapolis & Terre Haute (Vandalia) have adopted the Graydon heater, in which the steam is supplied direct from the locomotive to the pipes in the cars, and after making a complete circuit of the train is returned with its condensation to the tank of the engine. Should the engine be unable to spare steam constantly, then a reservoir in the baggage-car is brought into use, and the waste steam from the engine is stored in this and fed therefrom to the pipes. In case the engine is disabled, steam is generated in the baggage-car. Underneath each passenger car are placed two small cylinders for service when cars are detached. Before detaching a car these are charged with steam and are then ready for work. During the coldest weather of the past winter the detached cars standing in the yard have been kept comfortable for more than five hours, with a loss of only ten degrees of heat, the temperature in the cars being about sixty degrees above the outside temperature. This feature of the system is important, and the temperature in the cars is easily regulated by simply opening or closing a valve.

Iron and Steel.

The Alabama Rolling Mill Co., Birmingham, Ala., will issue $50,000 bonds to put in special machinery, and will probably enlarge its plant during the summer by the addition of a plate and sheet mill. The mill lately put in operation has a capacity of 25 tons of bars a day.

The rail mill department of the Little Rolling Mill, East St. Louis, Mo., resumed operations last week.

The Cleveland Rolling Mill Co. has received an order for 7,000 tons of steel rails from the New York, Pennsylvania & Ohio.

The Joliet Steel Co., Chicago, Ill., has contracted to furnish the Seattle, Lake Shore & Eastern with steel rails for 40 miles of track, and will commence delivering them about April 1.

The Rail Market.

Steel Rails.—Prices at Eastern mills are $31.50@$32, with considerable business in sight. We hear of orders booked for about 15,000 tons during the week.

Old Rails.—Iron rails are quoted at $21.50@$22 for T's, and $22.50 for double headers. Recent sales are of 200 tons T's at $21.25, and 200 tons D. H. at $22 on the dock.

Rail Fastenings.—Splice bars are quoted at 1.95c. per lb.; bolts and nuts, 3c., and spikes, 2.10c., delivered.

Flexible Fire-box Roof Stays.

One of our English contemporaries illustrate an improved form of direct staying with flexible stays. The flexible portions consist essentially of a wrought iron stay, with a head forming a portion of a sphere on the inner side, a wrought iron bush screwed into the boiler shell and formed to receive the head of the stay, and a copper seating between the head of the stay and the seating in the bush. A cap is added to prevent the escape of any steam that may escape through the joint. The whole forms a gas bracket joint, giving freedom to the stay to swing for some distance in every direction. These stays, we are informed, have been in use for over three years on the Rajputana Malwa Railway, India, and upward of 20,000 of them have been put in to replace the copper stays—which give continued trouble—with most successful results.

Broom Straw Feeders.

A correspondent of the *Locomotive Engineer* gives the following description of a car oil feeder or siphon:

"A small pipe is soldered into the oil cup, coming up within ¼ in. of the screw cap. This pipe is filled with common broom straws, which do not work in the cup and never stick; are not affected by heat or cold, and are easily changed to feed, more or less, by taking out or inserting a straw or two. They also catch all the dirt and the oil cannot run out when the engine stands still, as the feeder merely carries down oil thrown upon it. I have them in every cup, on rods and crosshead, and I would not trade them for all the fancy cups on earth. I took out all the screw tops on my cups that required a wrench and put in those with a taper thread and milled heads. I can take any of them off without a ton of monkey wrenches, and they never jar loose."

A New Steam Brake.

A new steam-driver brake has been invented by Mr. D. Clark, Master Mechanic of the Lehigh Valley, at Hazleton, Pa. It is operated by a button on the foot-board of cab, where the runner can easily reach it with his foot. It will apply the brake to drivers only, to drivers and tender, or to tender alone, at will. When in use it does not interfere in any way with the use of the hand brake, and is very simple. The automatic brake releases slowly, and on heavy grades the train gives a jerk back before the driver brakes allow the engine to start at all. With the new brake the steam releases as well as applies the brake, and is held on till the automatic on train is fully released and the train is free, then the steam brake is thrown off and train starts easier. A gauge attached to the brake cylinder shows the runner how much pressure he is using on the drivers.—*Locomotive Engineer.*

RAILROAD GAZETTE

Published Every Friday,
At 73 Broadway, New York.

EDITORIAL ANNOUNCEMENTS.

Contributions.—*Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and in their management, particulars as to the business of railroads, and suggestions as to its improvement. Discussions of subjects pertaining to* ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections appointments, and especially annual reports, some notic of all of which will be published.*

Advertisements.—*We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and those only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

We have repeatedly called attention to the dangerous moral effect of rate wars and of the particularly baseless one now raging in the Northwest. The following appears in the newspapers as an extract from a letter written by Judge Cooley to Mr. Blanchard. If Judge Cooley did not say it he well might have:

What is the matter with the railroads in the Northwest? Are they utterly reckless? Do they want to compel the Commission to come there and publicly investigate their methods and the secret manipulation of rates? Do they want to make hostile legislation in the future? I want to say that I am looking on with amazement at what they are doing.

We give space this week to a paper on the slide rule, which ought to have the effect of extending the use of that wonderfully handy little instrument. With Mr. Gieseler's clear explanation before him, *and* a slide rule, any intelligent man can learn to use it in three hours, even if he knows nothing of logarithms, and he can become tolerably expert with it with little practice. In fact, after he begins to use it he can hardly help practicing. Considering the time that the slide rule has been known, and the extent to which it is used abroad, it is surprising that it is so little used in America. The first fault, no doubt, lies with the technical schools, which so often teach little or nothing of the use of the handiest instruments.

Secretary W. F. Allen of the General Time Convention says, in the *Official Guide*, that

At the next meeting of the convention it is proposed to provide for a permanent record being kept of all variations and modifications which may be made in the Standard Code of Train Rules by the roads which adopt it as a whole; and it is probable also that provision will be made for the consideration of such future changes in the rules as experience may appear to render advisable, or advanced practice makes desirable.

This is every way desirable and it is to be hoped that the roads will enthusiastically support the movement. In a system where there are necessarily so many differences of opinion, where in various important features practice will never become uniform, it will be very easy, without some concerted action, to drift away from the standards set by the convention. The uniform code being somewhat of a compromise, many managers, with decided views of their own, will doubtless be able, acting as they do for a single road instead of a multitude, to make improvements in some features; and it is a duty to the convention if the convention's usefulness is to be perpetuated, to report these modifications for record. And it is to be hoped that the committee which framed the code, or at least a number of the men who were on it, will constitute, or be included in, the standing committee that is to be appointed. The original committee has been discharged and has well earned a respite; but if members look to the interest of the roads in the convention they will vote to have the same workers assume the burden again; the experience and knowledge gained in their numerous conferences are too valuable to be lost. If money will recompense them they should be well paid.

The Cincinnati, Indianapolis, St. Louis & Chicago announces that owing to complications arising at Cincinnati, Indianapolis and Chicago it will withdraw from the per diem arrangement and return to the former system of mileage basis for settling car service accounts with foreign roads from March 1. Other roads also are beginning to experience some of the disagreeable features of the new system, which every one knew would make themselves apparent sooner or later. The east-bound grain traffic being but moderate at present, some Western roads find themselves storing a lot of empty Eastern cars and paying for the privilege of doing so. This and other occasional gluts of empty or loaded cars are inevitable, and the question is whether the roads will become discouraged at the first cloud or will attempt to provide some way of adjusting the inequitable results of the new system. No one road can work alone, and it is apparent that concerted action must be taken. Like many other questions in practical operation, these differences concerning the proper amount to pay for a car or a hundred cars cannot be settled by correspondence, stretching through several months or years, and possibly they may not be found manageable by a central organization or bureau; but something should be done, and the larger roads should take prompt action so as to not only retain the benefit of their smaller neighbors' co-operation, but to do it without any movement that savors of coercion. Mr. Fink's and Mr. Blanchard's offices doubtless have a sufficient variety of affairs to attend to already, and it quite likely may be found that numerous local commissioners, on the plan adopted with demurrage at Omaha, will be necessary; but the most feasible opening for making a beginning would seem to be through the associations represented by these gentlemen. An impartial tribunal or authority of some kind will be a necessity, unless superintendents are willing to burden themselves with a mass of details which will absorb a great deal of time and thought without corresponding benefit.

Freight Train Brakes.

The real cause and nature of "shock" in long trains when a brake is applied is evidently imperfectly understood even by those who have paid some attention to the matter of freight train brakes. The letter of our correspondent "G.," which will be found on another page, contains many statements that are in direct opposition to the apparently unmistakable lessons of the Burlington brake trials and a new theory as to the nature, cause and prevention of shock is built upon what appears to be an erroneous interpretation of the facts as to shock.

Our correspondent asserts that a powerful brake on the front end of a train will prevent shock. Experience at Burlington showed, on the contrary, that a powerful brake at the front end of the train produced shock, and that shock was avoided when the brake was equally powerful over the whole train. The truth of this fact may be shown very simply and without going to Burlington.

As pointed out by "G.," the frictional resistance of the cars is in itself a brake of feeble power. Let us suppose a long, loose coupled train running on a fairly level track, and let us further suppose that the frictional resistance per ton of each car is equal, and amounts to the same figure as that of the engine and tender. It is evident that as long as steam is kept on, all the couplings will be stretched. When steam is shut off, the frictional resistance of the journals being alike on every vehicle is equivalent to a feeble continuous brake applied simultaneously and with equal retarding effect to every vehicle throughout the train. The train will, therefore, come gradually to a state of rest without disturbing the stretched couplings, because no car has any tendency to approach its neighbor, all being subject to the same retarding force. If, however, a powerful and instantaneous brake were applied to the engine and tender, the condition of things would be very different. Every car would close up, and the conductor and brakemen in the rear caboose would probably become fit subjects for a dentist.

It is, therefore, very evident that a powerful brake at the front end of a train, so far from preventing shock, is its primary cause.

The trials at Burlington proved conclusively that simultaneous action will effectually abolish all shock, whether the cars are loose or tight coupled, and whether they are all loaded or some are empty and others fully loaded, forming what was termed a "mixed" train.

It can be easily understood that no shock is felt when the brakes are applied simultaneously and with equal retarding force throughout the train, but the reason why no shock is felt with merely rapid application and a retarding force which is not proportioned to the weight of the cars is not so evident, and has never, we believe, been clearly explained.

It appears, however, to the present writer that it is evident that there is a shock whenever a brake is applied to a train, except only in the rare cases where the brake is absolutely simultaneous and exactly proportioned to the weight of each vehicle. It is evident that when these conditions are ever so slightly departed from the vehicles must tend to approach one another during the stop, and that this action must cause a certain blow on the couplers with loose slack and a decided surge or oscillation with spring slack. The shock may be slight, but it is there. Even with the latest form of Westinghouse brake the application is not absolutely simultaneous, and it may be interesting to analyze the conditions of a stop with this brake, and ascertain why the shock is not felt, though there is every reason to suppose that it exists. Let us assume that the brake is applied without appreciable loss of time on the engine, and in 1 second on the rear car, and that the whole train is stopped in 10 seconds. If the whole train is to come to a state of rest at the same moment, without any closing of the draw-heads and consequent shock, the power of the brake must be so proportioned that the engine is stopped in 10 seconds, the rear car in 9 seconds and the intermediate cars in between 9 and 10 seconds, according to their position in the train. We know, however, that the brake is not, and cannot be, proportioned in this manner. It is, therefore, evident that the whole of the train is not stopped at the same instant, or in other words, there is a strong probability that the rear cars are still running at a slow speed when the engine is stopped. This apparently should create a shock, but we know from actual experience that the shock is unfelt, though it appears probable that the immediate cause of shock,—a difference of speed of adjacent cars,—exists. An investigation into the state of affairs at the commencement of the stop may throw light on the subject. According to our assumption, the brake is applied on the engine for $\frac{1}{10}$ second before it is applied on the next car. In order to simplify calculations, it may be assumed in each case that the brake pressure in the cylinder rises to the maximum without appreciable loss of time. It therefore follows that $\frac{1}{100}$ part of the whole work of stopping the engine will be performed before the brake is on the next car. If the train is running at 20 miles per hour when the brake is applied, it has a velocity head of 14.20 ft.* It would therefore appear that the engine strikes the draw-head of the next car a blow equal to the weight of the engine falling through $\frac{14.2}{100}$ ft. or about $\frac{3}{4}$ in. This blow, however cannot be felt by an occupant of the car until the draw springs are fully compressed, which takes time. The engine and tender brakes may fairly be reckoned to act together, and taking their weight at 70 tons, the energy of the blow will be 70 tons $\times$ .0284 ft., or nearly 2 foot-tons. Such a force will barely send a powerful draw-spring home, and hence it is not surprising that no shock is felt on the car next the engine. It is also probable that the brake is applied on the car before the change of velocity and consequent blow on the draw-head has had time to compress the draw-spring. This is probably the reason why a quick acting brake prevents the blow due to the compression of the draw springs being felt. With a slow acting brake, the difference in velocity between adjacent cars is greater, one factor which increases the shock, and on the other hand, the draw springs are compressed and the shock felt before the brake is applied. In this case an unbraked car runs freely into the cars in front of it, which are not only traveling at a slower speed, but are held down to the rails owing to the action of the brake, and therefore form a quasi solid abutment against which the unbraked car strikes and recoils. The difference in velocity and the weight of the braked portion increases as the application of the brake travels towards the rear of the train, and therefore the shock is most severe in the rear car.

When, however, the application of the brake travels quicker than than the shock, the rear car is already braked when the shock reaches it, and presents considerable resistance to any decided change of velocity.

In no other way does it seem possible to explain two undoubted facts: 1. Simultaneous application will prevent any shocks being felt, even where some

*This includes an allowance of 6.14 per cent. for the rotative energy of the wheels, which is estimated to be correct for loaded freight trains.

cars are loaded and others not. 2. The brake must be applied on the rear car of a 50-car train within little more than 1 second after it is applied on the engine. If it is a fraction of a second slower, a severe shock is the result.

The practical bearing of these observations is found in their application to the possible success of any system of buffer brake. It is reported that no less than three systems of buffer brakes—the Turner-Beard, the Manomatick, and a modified form of the Widdifield & Button—will shortly be presented for another series of elaborate trials. The representatives of all these systems claim that a buffer or momentum freight brake can be made to work with a very small amount of shock. Past experience throws a doubt upon the probability of a buffer brake acting without shock. Private trials, however, appear to have shown that the amount of shock with the Widdifield & Button brake was much diminished by making the brake less sensitive to any small movement of the draw-bars. Given a powerful brake on the engine, a decided movement of the draw-bars can be obtained, and this alone will apply the brakes. The brake will therefore not be applied when the draw-springs are slightly compressed, and the terrific jerks experienced in graduating the buffer brakes at Burlington in 1886, will probably be unfelt when the brake is lightly applied on the engine.

It is, however, very doubtful if the amount of shock can be reduced within a reasonable limit. In any system of buffer or momentum brakes yet devised, a movement of the buffer, or in other words the conditions causing shock, must precede the application of the brake. It has been clearly shown that with continuous brakes, shocks can only be avoided when the brake is applied to each vehicle simultaneously, or at least quicker than the shock can travel. In other words, the brake should be applied before the shock, a condition which seems impossible in buffer brakes.

If, however, a cheap and simple form of momentum brake can be made to work with a small or unobjectionable amount of shock, the brake question will have entered another phase; but while a good buffer brake would undoubtedly be a useful aid to railroad working and a great improvement upon the hand brakes at present in use, it may be doubted whether the lessened cost and the absence of brake couplings between the cars would compensate for the want of automatic action, which seems likely to be even more valuable in freight than in passenger service.

The Strike.

Mr. Arthur still remains at Chicago, and the brotherhood maintains a solid front, but the officers of the road claim—and with considerable reason—that they have won the fight. No statements are given as to the exact status of the train service, the amount of freight waiting to be shipped, the cost of pilots and other instructors and the loss entailed by shrinkage of traffic; but from the general statements made it would appear that at least half of the regular force of enginemen and firemen have been replaced; and if these new men are fairly capable the company can doubtless keep its head above water until a full force can be secured. The surplus or floating element in this, as in other trades, and the ease of communication between all parts of the country are elements of strength for the road which the brotherhood did not fully calculate. They did not realize that the country had grown 15 or 20 per cent. in population and resources since their last fight.

An interview with a conservative member of the brotherhood reported from Chicago throws some light on the motives that actuate the men and partially clears up the doubts of those who have been surprised at Mr. Arthur's position. This member says that the conservative element in the order has been gradually losing ground, and that the "fighting element" has succeeded in modifying the powers of the chief officers. Mr. Arthur is now an adviser instead of an arbitrator, as formerly. While this may not be strictly true, it gives color to the reports that Mr. Arthur was overpersuaded in this case, and the probability of its correctness is strengthened by the somewhat blustering attitude assumed by Mr. Arthur, which is very much unlike him at his best.

The threatened ordering of a strike on, first the Burlington's neighbors, and afterwards on the whole railroad system of the country has been a topic of speculation during the week. No reason has been given for action of this kind except the statement that it "has been learned on good authority that managers throughout the country have secretly combined to aid" the Burlington. Any evidence of anything of this kind is wholly wanting, and a general strike would be nothing less than a conspiracy to prevent innocent roads from doing their duties as common carriers. The general opinion is, that no such reckless defiance of public opinion will be attempted, though various circumstances have occurred indicating that the principles of the brotherhood and the voice of its management approve of the disgraceful methods of the boycott. In four or five instances enginemen of other roads have stopped certain kinds of traffic or have performed certain service only after getting permission from the headquarters of the order, thus showing that they require no very strong pretext to induce them to "tie up" other roads, provided they conclude that it will be for their interest to do so. The extreme folly of such action must, however, be apparent to the great body of the brotherhood. The sense of fair play common to all men condemns it, and in a strike for wages which are already high, *as viewed by the public* whose sympathy is essential to success, it would be suicidal. The courts agree with public opinion on this point, Judge Brady of the New York Supreme Court deciding virtually, this present week, in a case where the Knights of Labor threatened to order a strike in any shoe shop which should employ a certain foreman, that all sympathetic strikes are conspiracies. The late strike of trainmen on the Philadelphia & Reading started in an attempt by the men to dictate what freight the road should and should not handle, and failed to secure the least public sympathy. The inconsistency of "striking" one road because it is supposed to be aiding another, while accepting and demanding aid themselves from the employés of all roads, should be borne in mind by the brotherhood men. We regret the course taken by several of the roads in yielding to the demand of the strikers that they shall handle no C., B. & Q. freight. It is said that some of these roads prefer a lawsuit to a strike. Does it not occur to them that they are putting themselves in danger of both?

The causes leading to the strike and the merits of the question at issue are still considerably clouded. Neither side has put forth a full and fair comparison of the actual wages paid on this and on other roads, though each has apparently stated such facts as support its own position. The figures printed in another column of this issue give a fair idea of the rates hitherto in force as far as can be ascertained without the records of actual work done. The road evidently aims to make the easy runs cost it less than the hard ones. The averaging of all, while it would violate well-known principles, would very likely be acceded to by this or any road rather than have a severe struggle, provided the gross outlay were not increased. But what the men want is both an averaging and an increase.

It is not unlikely that a material part of the grievance lies in personal considerations. The road is accused of having parted with one high officer because he was too liberal with the men, and since the departure of another (Mr. Potter), the policy towards employés is said to have changed. It may well be that the management, while having and maintaining a just position, has dealt in such a way that the *manner* of treatment has become the final straw on the camel's back. But Chief Arthur's whole reputation rests on his tact in dealing with high-strung and unreasonable people, and it is inexplicable that he should fail at the point where his special qualities were most needed.

The Lease of the Oregon Railway & Navigation Company's Lines.

The joint lease of the Oregon Railway & Navigation Company's lines to the Northern Pacific and the Union Pacific has aroused much opposition in some localities in Oregon and Washington territories. It has been ratified and executed, we believe, by the directors of both the latter companies and awaits the action of the former. Now it is said that an injunction has been obtained restraining the officers of the Oregon Railway & Navigation Co. from executing the lease. It is not anticipated that the delay will be long. Probably at the furthest it will not endure longer than till the annual meeting, the third Monday in June, but it is of interest to look somewhat into the conditions and causes of the present opposition.

The charter of the Oregon Railway & Navigation Co. requires that a majority of the directors shall be residents of Oregon. The board has 13 members. Of the present Oregon directors three are employés of the company and represent the Eastern stockholders, while the other four are directors by virtue of their ownership in the securities of the company. These latter are said to be in sympathy with the citizens of Portland, and are using every means, if current reports are true, to put obstacles in the way of the lease being ratified. Some of the newspapers, notably the *Oregonian*, claim that the joint lease is in direct violation of the Inter-state Commerce law, and advocate an appeal to the courts, on what grounds is not quite clear.

The opposition on the part of the Portland people to the joint control of this line by the two Pacific companies is partly the result of conditions which have been working for some time, and date as far back as the completion of the Northern Pacific in 1883. Without going too much into detail it may be said that this opposition arises indirectly from the opening up of transportation facilities between the Eastern states and the interior towns of Oregon, Washington and Idaho, and more directly from the completion of the Northern Pacific across the Cascade Mountains to Puget Sound, connecting Eastern and Western Washington and affording direct communication with the East.

Prior to 1883 and the completion of the first transcontinental line into Portland, the entire "inland empire," comprising the larger portions of Oregon and Washington territories, was tributary to Portland. Portland was the gateway through which all commerce must pass. The Puget Sound country had water communication with the rest of the world, but the Cascade Mountains raised an impassable barrier to any direct connection with the great fertile country on the east. A merchant in the interior, therefore, had no other recourse than to go to Portland for all his supplies, or incur long and vexatious delays in shipping from the East via San Francisco. That Portland exacted toll from all the back country is vouched for by the people who bore the burden, and is indirectly attested by the claim now made by the residents of Portland that their city is wealthier per capita than any other in the United States.

The advent of the rail lines bringing direct communication with the Eastern states did not bring the increased prosperity to Portland that had been anticipated; in fact, the reverse for a time appeared to be the result. Trade connection was established between interior towns in Oregon and Washington, and Chicago, St. Louis and New York. This created a competition which Portland had not before experienced, and to which her people have not yet become reconciled. There still prevails a sentiment among them that all the territory west of the Rocky Mountains somehow belongs to Portland, and should be tributary to their city. Their position on the coast gives them the advantage of water transportation and low rates, and the recent ruling of the Interstate Commerce Commission, temporarily suspending the application of the long and short haul clause, afforded the trans-continental lines an opportunity to make much lower rates to the coast than were made to intermediate points into the interior. This put Portland in position to still retain by far the greater portion of her inland trade. Notwithstanding these favorable conditions, any adjustment of tariffs by transportation lines which will permit a lower rate from the East to an interior point than the rate from the East to Portland, added to the rate thence back to place of destination, is sure to meet with the hearty opposition of the people of Portland. As this, however, is only looking after their own interests, it is but natural, and what might be expected under the circumstances; but it is only a question of time when they will have to adjust themselves to the new conditions. The railroads cannot very well, by any reasonable policy, bring back a state of things similar to the old.

The completion of the Cascade division of the Northern Pacific across the Cascade range to Puget Sound has opened up direct communication between that section and the East without passing through Portland. It has given a new impetus to the settlement of that country, incidental to which is the rapid building up of Tacoma and Seattle. These two cities have recently been advancing in population and importance very rapidly, and it will not be long before they will contest with Portland the commercial supremacy of Oregon and Washington. The cities on the sound certainly have the advantage in position. They are on deep water. Vessels can sail into their harbors without a tug and without a pilot. There are no hindrances to navigation. Portland, on the other hand, is nearly 100 miles from the coast. The bar at the mouth of the Columbia is difficult and at times dangerous to cross, and after vessels are once inside the bar there are heavy expenses for pilotage and towage. All of these circumstances operate to divert some of Portland's trade to the Puget Sound ports.

The principal commodity of export from Portland is wheat from the interior. Heretofore the only outlet for this product was by way of Portland, but last summer the Northern Pacific built the switchback

over the mountains, and lately wheat has been sent direct from the interior to Tacoma for shipment from that port. Several vessels have been chartered and loaded with wheat from Tacoma during the past few months, and dealers at Tacoma have been able to pay about two cents per bushel higher than the ruling prices at the same time in Portland, The country opened up by the Northern Pacific proper is newly settled and does not contain the same amount of wheat acreage that the old settled portions do that are tributary to the Oregon Railway & Navigation Co. It is reported, however, that one of the provisions of the joint lease is that Tacoma and Portland shall be common points so far as wheat rates are concerned.

If that is true it means that the growers at all points on the line of the O. R. & N. shall have the choice of either market, and under the present conditions much of the wheat will naturally go to Tacoma. With the O. R. & N. operated independently the wheat tonnage tributary to it would go to Portland. Moreover, with the Northern and the Union Pacific competing for the Portland trade, and building branches into each other's territory, the Portland merchants would be in a position to make terms that would help them to hold the supremacy of their city.

The opposition to the joint lease may therefore be accounted for without attributing it to a proper fear of the evils of "monopoly" and "consolidation," or to a just vigilance in guarding the interests of the people. In fact, it is said that while Portland is trying to prevent the lease the people of the interior are anxious to have it carried into effect, for they foresee better prices for wheat with an outlet to Tacoma. Whatever may be our judgment of the effect of the lease, it is well to look honestly for the forces which oppose it.

Highway Crossing Signals.

One of the most imperative needs to-day in railroad appliances for the safety of the public is a reliable and efficient protection for highway grade crossings, reliable in being able to work for a long time without failure, and to give warning of coming derangements before they occur, and efficient in effectually preventing persons or teams from getting on the track when a train is in dangerous proximity to the crossing, or else in preventing trains from reaching the crossing when in use as a highway. It is also desirable that horses should be prevented from even seeing approaching trains and being frightened thereby. This last condition is often impossible to attain by any means, and the only absolute protection from the other dangers is the separation of grades. This, however, will for many years be impracticable for the great majority of highway crossings. In Iowa we find that 93 per cent. of the highway crossings are at grade, and in Connecticut 84 per cent. These figures may be taken as representative of the average condition, East and West. It being admitted then that the usual road crossing must for years be at grade, it remains to consider how it can best be protected.

The best means yet used is a trusty flagman, with gates to be lowered at a seasonable time before the passage of every train. This is by far the most common means, where any sort of protection is resorted to; but where there are several tracks (and sometimes where there are not) even this is not always sufficient. The flagman may be careless, or trains may be approaching on different tracks, not all of which he may see, and he may raise the gates when the first train has passed, in time to allow an accident by the second. Many instances are known of accidents due to one or the other of these errors of the flagman. It is desirable to eliminate him altogether by means of some automatic apparatus; and if he is retained it is desirable to supplement his fallible faculties and judgment by some independent means.

There are two general classes of contrivances which are intended to make a flagman unnecessary, or to protect those crossings which, while subject to considerable travel, still have not enough to warrant the expense of gates and a flagman. The first is automatic gates, the second automatic signals.

Automatic gates are hardly to be seriously considered. A few applications have been made, but usually with the result that they failed to work owing to the necessary, or unnecessary, complications of the machinery required to operate them; or, as has sometimes happened, persons or vehicles were imprisoned between the gates, and exposed to far greater danger from the approaching train than if there were no gates at all.

The use of gates worked from an interlocking tower is a special case of very limited applicability, but very efficient when it can be adopted. By interlocking the gates and adding derailing switches almost absolute safety can be had, and, so far, this is the next best thing to separation of grades. But the expense of this system must limit its use, and a strong argument against adding derailing switches is found in the multiplication of facing points. Moreover, a serious objection to interlocked gates is found at points where travel is heavy, because of the delay to trains, teams and pedestrians involved in closing the gates some time before the arrival of trains.

The inventions alleged to be perfected highway crossing signals are almost without number. On paper or in a workshop they work with all the certainty that could be desired, but when subjected to the severities of our climate and the rough use of actual service, either fail altogether or show that they cannot be safely depended upon. Not one of the devices now in use works without failures, and some fail so often as to be absolutely unreliable. The failure to give an alarm when a train is approaching is the most common trouble, and, it may be added, the most dangerous. Those inventions, however, which are most free from this sin of omission have one of the opposite nature scarcely less objectionable; they give alarms when there is no danger. This is a serious annoyance when some impatient traveler is detained, perhaps, for several minutes, waiting for a signaled train that does not come; and, if often repeated, this class of failures tends to de troy all confidence in the indications even when genuine, and renders it probable that some time they will be disregarded and an accident will result. Those devices which least often fail are the most dangerous when out of order, because a failure is least expected, and so the less likely to be discovered before some catastrophe calls attention to it. Even when the automatic bell signal works well it is only a warning, and will be often disregarded by the reckless and by those ignorant of its meaning. In this respect it is doubtless less efficacious than the flag. It is well known that the arm gate is frequently no barrier against pedestrians who will pass under it in the craze to dash across a track ahead of an approaching train.

But with all its imperfections the automatic crossing signal is still better than nothing, and if a good one is used and it is *well looked after*, it will be found very much better than nothing. No doubt much of the dissatisfaction which has so commonly followed experiment with them has come from the fact that they have not been inspected and maintained with proper care. It is undoubtedly true that, counting interest on first cost, renewals and repairs, and the pay of a competent inspector, a crossing can be protected by automatic signals at much less cost per annum than by a flagman. This being so, it seems advisable to try them at points where the traffic is not such as to warrant more expensive protection; and as they are found effective, their use can be extended to more important points, as auxiliary to flagmen.

It is hardly necessary to add that we would not say a word to suggest delay in adopting the only really effective means of protecting highway crossings, which is to put them either under or over the grade of the railroad; but even a railroad must creep before it can walk, and it is common sense to make creeping as safe and comfortable as it can be made. If we are to do nothing until we can do the absolutely safe thing, we should give up gates and flagmen, for it is well known that many more people are killed at crossings so protected than at those entirely unprotected. Of course, this only shows that the crossings most used are those which it is sought to protect. It proves nothing against the usefulness of the means adopted.

Passes.

The increase in passenger revenues which a year ago was predicted by many as quite certain to result from the enactment of the Inter-state Commerce law does not prove to be important, or at least is not easily distinguishable if it exists. While there has very generally been a material reduction in free travel, the increase in paid fares from this cause is in most or all cases imperceptible, the increase in general travel being in all sections of the country so marked that the portion of it to be credited to former dead heads cannot be traced, though it is generally agreed that it is small.

It may be stated as a general truth that managers have for years realized the cost of the "pass evil," and the possibilities of demoralization connected with it, and that they have been on the alert to check it whenever a way seemed open; and that whatever shrinkage they have lately been able to effect in this ever-flowing stream of highly valued autographs has been largely independent of the Commerce law, strictly speaking. That is, the freezing out of some of the favored ones by force of law has been used as the excuse and occasion for cutting off many others at the same time. Roads wholly within one state have been able to materially reduce the number of passes given to influence freight traffic, because their inter-state competitors give fewer passes of that sort, and honorable managers, who believe this practice an evil to be abolished, have no doubt made considerable progress in this respect.

Views as to the actual saving vary widely. The extent of the "pass nuisance" is almost universally measured by the number of passes issued rather than by the mileage traveled; the number of times the pass book has to be taken out of the drawer is more apt to be thought of than the value of plush seats worn out. The prudent-minded woman's rule for making a rhubarb pie was to "sweeten it all you dare to, then shut your eyes and put in another teacupful of sugar." Perhaps managers shut their eyes to free mileage because they are similarly afraid of the facts. A trip pass is grudgingly given, and the number of them is often scrutinized, while an annual pass, on the same size of pasteboard, and taking the same quantity of ink, represents, perhaps, a hundred times as much expense or loss to the road, but it appears less monstrously wicked because it comes to mind only once a year. One well informed officer, who writes to us on the subject, estimates that only one-tenth as many passes are given out as formerly, but he evidently takes no thought of mileage. In fact, he thinks that too much thought of it has been taken already, believing, as he does, that the thousands of passes given in the last 25 years have been of unmixed good to the roads directly, and also indirectly, by preventing a general sluggishness in the community. Another and perhaps more careful judge thinks that free mileage formerly constituted on the average 20 per cent. of the whole passenger travel; that half of this was by employés on their own roads, and that half of the remainder has been cut off, leaving the total now 15 per cent. That is, this authority says, the actual reduction in free mileage is one-fourth. This may well be, and still the estimate of nine tenths saving in cardboard be somewhere near the truth. Passes to employés of other roads undoubtedly figure largely in this reduction, and these were expressly exempted from the operation of the new law. Unquestionably a good many who formerly rode free now stay at home. This class, at least, can taste a sweet revenge, as the roads have saved practically nothing, unless the cutting off has enabled them to take a car off a train.

One prominent road, at least, does keep the mileage of passes. This road's lines are largely within a single state, so that few roads of consequence (except the New York Central, which is wholly in New York), have a smaller proportion of inter-state travel; its free travel, excluding postal clerks and its own employés, has fallen off about 20 per cent. One Northwestern general manager does not bother himself with percentages – in one department at least. He says that last year shippers, state and county officers, etc., got 300 passes out of him, and that this year they shall get none at all, either state or inter-state. May the blizzards never abate his courage! Government officials, including the classes just mentioned, together with Congressmen, undoubtedly feel the effects of the Inter-state law quite seriously as a whole, and a Chicago paper earnestly advocates an increase of $1,000 in Congressmen's and United States judges' salaries on this account. There can be no question that this recommendation is in accordance with right principles.

Many roads have taken very illogical action, as for instance in the passing of employés' families. The law is not precise on this point, and each manager can make a law for himself. We see, therefore, a number of grades of liberality. In the first place every one knows that many of the trip passes granted to employés themselves "on account of the business of the company" are really for journeys of pleasure or private business, but nobody thinks of curtailing these much more than has been the practice heretofore, because custom has become so firmly entrenched as to have virtually the force of law. Then come employés' families. A strict constructionist can of course cut these off entirely, if he choose, and can easily refuse them for trips within a single state if he deem this the best time to make such a change. Here are already various standards of action and we have only begun on the list. In dealing with employés of other roads another possible half dozen standards come in for consideration. The most common "injustice" that has been heard of is, perhaps, the practice of those roads which pass their own employés *with* their families, but to the men of neighboring roads will grant none for the "family." While, of course,

there is no injustice in this or even in a much severer cutting-off, the idea that the Inter-state law has any real bearing in the matter is ludicrous. Congressmen evidently live in the atmosphere of the good old times when a "railroad man" needed nothing but his reputation to travel upon either at home or abroad, and so they have innocently passed a law on the theory that a road will invariably treat its neighbor's employés as precisely on a par with its own. As to families, they apparently gave hardly a thought, and although there is ample room for a superintendent to cut off every wife, daughter, cousin and sweetheart, it would probably be quite a surprise to congressmen, and most others as well, to hear that any complaint of illegal passing of any railroad man's wife had reached the Inter-state Commerce Commission.

The cutting off of a portion of the free travel whenever a good opportunity offers, law or no law, which we have alluded to above, is a necessary process, and likely long to remain so. As long as free rides are given as a favor, inequalities will creep in and the abuse will grow until some occasion arises for cutting off the dead-heads by the wholesale. Then the process begins again. Many roads that used the knife very boldly a year ago have now gradually worked back to somewhere near the limits of the law.

The Fallacy of Strikes.

The following letter which we have received from a well-known western superintendent is a good presentation of the employer's view of the difficulty under discussion. The reference to the need of backbone is especially apt; it is somewhat astonishing to hear of a half dozen cases where superintendents of roads connecting with the Burlington have allowed their enginemen to say what cars shall, and what shall not, be hauled in a train. The courage and firmness of the Burlington officers seems to have inspired their neighbors with the opposite qualities. Our correspondent says:

"Like others of my profession, I have watched with interest the effects from day to day of the strike of the locomotive engineers and firemen upon the Chicago, Burlington & Quincy, and I cannot but comment upon what must be the result and the lesson learned. History will repeat itself, and where a principle is involved right is always might. That an employé should dictate to his employer what he shall be paid is without law or reason, and especially so when he has the privilege of quitting without notice, at no matter what inconvenience or cost to his employer. This principle has been too often applied by organized labor, with the same results, to admit of further argument.

"As an operating officer of a railroad, I have felt some interest in the Brotherhood of Locomotive Engineers, for in my intercourse with them I have found the Order to be composed of men of good principles and, so far as I know of their by-laws and regulations, they were controlled by wise council. They have been represented to be a non-striking organization, but we now see the fallacy of such representation.

"Having reviewed several labor strikes the past two years, I have, in each case, noted with interest how a little firmness on the part of the railroads would have brought about better results. The weaker ones who would rather pay anything than have a strike have submitted in many cases to the demands made upon them by the Brotherhood, and signed away their own rights, which in itself has given the men strength, and led their followers to believe that they were invincible. I have seen too many cases of weakness of the backbone in railroad officers by their acceding to unreasonable demands which have always come back to them with compound interest. It is just such firmness as has been displayed by the Reading and C., B. & Q. that will help establish the principle that right is might, and free the public of these disturbing elements.

"A road cannot object to an employé belonging to any organization, as he is employed on his merits to perform certain duties and comply with the rules of the company; but when he is led by some hot head, who has more tongue than brain, to believe that the organization to which he belongs can get what it demands, whether reasonable or not, he is very apt to soon after regret that he ever joined that organization; and such I fear will be the result of the present strike upon the C., B. & Q., when engineers of long standing, with their little homes secured, find themselves without employment, and what has taken years to accumulate must go in a moment. The lesson has been a costly one, but I trust it is one that will be profitable to the Order which has stood loyally together.

"But 'there's a Divinity that shapes our ends, rough-hew them how we will,' and we can only be governed by good principles. I think I voice the sentiment of the railroad fraternity when I say that striking is not a good principle and will not win."

The Pennsylvania Report.

In another column we give an abstract of the directors' report of the Pennsylvania Railroad for 1887. This report gives the earnings and expenses for all traffic for each division, but they are not analyzed, so that until the fuller report appears it is impossible to tell what of the increase in expenses is due to transportation and what to maintenance; nor does the general account appear in this report.

On all the lines east of Pittsburgh and Erie the increase over 1886 has been:

	Increase.	Per cent.
Gross earnings	$5,292,236	10.5
Expenses	4,466,960	13.6
Rental and interest on equipment	245,465	5.5
Net earnings	579,780	4.4

On all lines west of Pittsburgh the increase over 1886 has been:

	Increase.	Per cent.
Gross earnings	$6,815,835	20 2
Expenses, interest and rentals	5,742,957	17.2
Net earnings	1,072 676	521.2

On all lines owned and controlled the increase has been:

	Increase.	P.c
Gross earnings	$13,817,525	14.6
Expenses (excluding rentals, etc.)	10 135,368	15.1
Net earnings	3,682,158	10.6

The ton-miles east of Pittsburgh and Erie have increased 12.7 per cent., the passenger miles 12.4 per cent.; while west of Pittsburgh the increase in these units of traffic has been 16.8 per cent. and 14.2 per cent. respectively.

The earnings and the profits per ton per mile on the lines east of Pittsburgh and Erie continue to decrease, but per passenger mile, receipts have increased and cost has declined, making a net gain of .045 of a cent. per passenger mile. These data are not given for the western system, and we are left in the dark as to all the causes for the great increase in net earnings on that system, but the great gains in both passenger and freight mileage there will be noticed. The expenditures on capital account, both on the eastern and western systems, have been very heavy. For increased facilities between New York and Pittsburgh over $4,000,000 was thus expended, while on branches and auxiliary lines over $2,200,000 was expended. Deducting $680,000 cash received from some of the branches, and adding $2,600,000 spent on the western lines, we find for the whole system $8,120,000 expended on improvements and charged to capital account. It has been generally believed during the year that an unusual expenditure of this nature has also been charged to operating expenses. To ascertain how much of the actual improvement of the road and equipment has been so accounted for, we must wait for the full report.

It will be remembered that the second dividend of the year was three per cent., making for the year a total dividend of five and one-half per cent., against five per cent. in 1886. Nevertheless, the surplus balance for the Eastern system carried to profit and loss was $1,983,599, making the total now standing to the credit of profit and loss $17,608,948.

The report indicates a continuance this year of the heavy expenditure for improvements, including, if the business of the year warrants it, raising the tracks in Jersey City.

The car-trust account represents an expenditure of $21,886,000 for 42,376 cars. The certificates redeemed amount to $12,194,000. This account was increased during the year by the issue of $1,000,000 four per cent. certificates and decreased by the redemption of certificates for $875,000.

Steel Production for 1887.

In the last number of the *Bulletin*, Mr. Swank returns the production of all kinds of steel in this country for the last year as 3,339,071 gross tons. Of this 2,936,036 was Bessemer, in which is included 41,400 tons of Clapp-Griffiths steel.

The production for the last three years has been as below, all quantities in gross tons:

	1885.	1886.	1887.
Steel rails	959,471	1,526,410	2,149,638
Bessemer steel	1,519,430	2,269,190	2,936,036
Percentage used for rails	63.1	67.6	69.8
Open hearth	133,377	218,973	322,069
Total steel produced	1,711,910	2,562,503	3,339,036

That is, we have used an increasing proportion of Bessemer steel for rails, the increase having been at the rate of 113.6 per cent. on rails and 93.2 per cent. for Bessemer steel. Either percentage shows a very satisfactory improvement, but our open-hearth steel shows a larger gain, 141.5 per cent., though it is a gain on a much smaller quantity, over 61 per cent. of our total steel production for last year having been made by the pneumatic process.

Mr. Jeans does not, as Secretary of the British Iron Trade Association, return the production of crucible and special steels; but for 1886, the last year for which returns are received, the English make of Bessemer steel was 1,570,520 gross tons, and of open-hearth steel 694,150 tons.

We imported during the last year 137,588 tons of steel rails, and 483,905 tons of blooms, wire rods, etc., so that we must have consumed during the year very nearly, if not quite, four million tons of steel. Our importation of iron of all kinds is given as 1,783,251 tons. This, with the pig iron of domestic production, 6,417,148 tons, indicates a consumption equivalent to nearly 8¼ million tons, or, allowing 60 million inhabitants, 300 lbs. per head.

Our pig and rolled iron has always been of high quality, and for several years our tool and special steel makers have been able to fill orders to about any specifications which were drawn. Now the rather onerous requirements of the Navy Department for plates, angles and beams, coupled with the tensile strength and elasticity required for our built-up guns, have familiarized our open-hearth makers with the manipulations necessary to turn out the highest class of work in that material, while success with the gun cast at Pittsburgh from Bessemer steel would possibly so improve our make of pneumatic steel that it could be sold for special or crucible steel with less strain on the conscience of the vender than at present.

There is nothing to indicate that there will be any falling off in the quality of our production, but there will almost surely be a decrease in the quantity required during the present year.

The solid Bessemer steel cast gun, a notice of which appeared in the *Railroad Gazette* of Feb. 10, has been successfully bored and annealed by the Pittsburgh Steel Casting Co., and is now to have its last boring before being shipped to Washington to be rifled. The annealing, which was done by natural gas, occupied two weeks, and so far no defect has been found in the gun. If it stands the severe test to which it is arranged it shall be subjected, it will be a decided triumph for American steel founders, nor should a failure be disheartening, as it is said no built-up guns have been subjected to such rapid fire as is proposed for the test of this gun. Speaking of the reported failure of several built-up 9.2 in. guns under proof at the Royal Arsenal, by splitting their tubes or jackets and the recent bursting of a 10 in. 38-ton gun, the *Broad Arrow* says: "Either the mode of construction, the steel used, or the system of rifling calls for searching inquiry before proceeding further with the present costly construction." Mr. Hainsworth, the Superintendent of the Pittsburgh Steel Casting Co., proposes to offer the government, it is said, a cast steel gun of the size and strength of the 110 ton built-up gun for $175,000, instead of $225,000, the cost of the built-up gun. Whether the first cast gun is satisfactory or not, the difference in price between the two kinds is so great that the government should continue ordering cast steel guns, both of Bessemer and open-hearth steel, until their capabilities are fully established.

Here it is well to note that there is a proposition before Congress to appropriate $1,000,000 for another factory for large guns, to be under the control of the army, the present one at Washington being an appurtenance of the navy department. If such a bill should pass it will probably long prevent our manufacturing guns for other powers, as no one would be apt to expend $1,000,000 for machinery to manufacture guns when it was certain there would be no home market for them. On the other hand, a government order for finished guns, such as was given to the Bethlehem Co. for forgings, would undoubtedly place a better plant at the disposal of our officers, than Congress would give appropriations for. In private works guns made by mechanics trained also in economic administration would, while subject to government inspection, cost less than if made in government shops, while part of the interest charges and cost of maintenance would almost surely be borne by foreign governments. The great works of Krupp are as much at the disposal of the German government as if they were government property, while all the nations which buy its guns share in the cost of its maintenance, and help pay for the perfection of its methods and machinery.

A good example of legislation against railroads run mad is presented in a North Carolina case (State v. Divine, 4 S. E. Rep., 477). A statute of that state passed in 1880 provided that in certain counties in the state, whenever any livestock should be killed by any engine or car, it should be *prima facie* evidence of negligence, and that the President, Receiver or Superintendent of the road, and also the conductor and engineer of the train, should be indicted and on conviction punished by fine and imprisonment. It was provided, however, that if they, within six months after the killing, paid the owner of the stock his price for it, or (if they thought the price too high) left it to arbitration, such payment should be a bar to the prosecution. The Supreme Court very properly holds this curious piece of statutory law unconstitutional, and for a good many reasons: *First*, because it is a local law applying to only a few of the counties in the state. *Second*, it is a partial law making a crime in a railroad officer or employé what may be only a misadventure or an accident, acts for which other men are not criminally liable. *Third*, it takes away the presumption of innocence, which shields every man in a criminal prosecution, and substitutes a presumption of guilt from the fact of the happening of the act. *Fourth*, it makes a railroad officer punishable for an act in which he may not have concurred or which he may not even have known about. *Fifth*, it gives to private party the right to threaten a person with a crimin prosecution to compel the settlement of a civil claim for damages. And *lastly*, it deprives the railroads of the right to have their civil liabilities passed upon in the civil courts, by threatening their officers with fine and imprisonment if they do not settle all claims for injuries of this kind either at the price fixed by the claimant or by an arbitrator. A copy of Judge Cooley's book on constitutional law should be presented by the railroads to the statesman who drew this statute before he has time to tackle such legislation again.

The first volume of the Report of the Chief of the Bureau of Statistics for the year ending June 30, 1887, is received. Mr. Switzler gives the value of our foreign commerce as $1,408,502,979. This exceeds that of any year since 1883, but was exceeded in that year and the three preceding it. The balance of trade in our favor was less than 24 million dollars, which is the smallest since 1876. The decline in the value of our foreign trade since 1883 is to a considerable extent due to the general decline in prices, which Mr. Switzler shows by a series of tables. The value of our exports of domestic merchandise has increased from 316.2 million to 703 million dollars, an increase of 122 per cent. In fact, the value of our exports to the United Kingdom of Great Britain and Ireland last year amounted to 363.1 million dollars, or about 47 million dollars more than our total exports in 1860. Our exports of the products of agriculture increased in value from 1860 to 1887 by 266.5

million, or 104 per cent.; the products of manufacture increased by 91.1 million, or 199 per cent., and the products of mining, fisheries, etc., increased by 31.2 million dollars, or 222 per cent.

The value of our imports increased from 353 6 million dollars in 1860 to 692.3 million in 1887, an increase of 96 per cent. Our imports from Europe increased 80 per cent.; from North America, 128 per cent., and from Asia and Oceanica, 190 per cent. Our imports from Germany increased 336 per cent. As of old England is our best customer, taking 52 per cent. of our exports and furnishing us 24 per cent. of our imports, against Germany's 8 and 1½ per cent.

In connection with our exports of agricultural products very full tables of the wheat production of various countries are given and a table from official sources showing the imports of wheat and flour into the United Kingdom from various countries from 1840 to 1886, both years inclusive. Also a table showing the exports of provisions for 1860.

The report continues the story of our loss of the ocean carrying trade, saying that only 14 per cent. of our foreign trade, measured by its value, is carried by home vessels. There was a decline in the proportion of values of commodities carried in our own vessels from 75 per cent in 1856 to 14 per cent. in 1887. On the lakes American tonnage increased 5.3 per cent. and foreign tonnage decreased 26.5 per per cent. The total tonnage of vessels built in the United States during the fiscal year was 156,602 tons, of which 22,122 tons were sold to foreigners. The tonnage built is, excepting 1886, the smallest since 1845.

The number of immigrants returned as entering this country during the fiscal year was 490,109, of whom only 161,748 were from the United Kingdom or spoke the English language. Germany contributed 106,856, Sweden, Norway and Denmark, 67,692, and Italy, 47,532. Only 10 Chinese are returned. The above figures do not include the immigration from Canada and Mexico.

One of the most amusing suggestions which we have seen with regard to the sale of railroad tickets comes from the French Minister of Commerce. His idea is that the railroads should sell mileage tickets at rates varying according to the amount purchased. That is to say, a 10,000-mile ticket would not cost twice as much as a 5,000-mile ticket, nor a 5,000-mile ticket twice as much as one for 2,500 miles These tickets are to be good on all railroads and for all persons. Instead, however, of containing mileage coupons, they are to be more of the nature of check-books. The holder is to write a sort of check, indicating his starting point and his destination, and the distance between the two. In return for this check he will receive a regular ticket. No reduction in expense is expected from the project; it is simply an application of the wholesale principle in its most objectionable form. It is, nevertheless, boldly defended by the Minister—apparently on the ground that there is a natural reason for selling things lower at wholesale than at retail. The most marvelous thing about this measure is that the state railroads of France have declared themselves ready to adopt it. We imagine that the private companies will have too much sense to enter upon a course of action which would simply favor the rich at the expense of the poor without offering any advantage in railroad economy. We trust that they will not be misled by the Minister's statement that "this system is in successful operation in the United States."

We have already mentioned that the increased railroad activity of 1887 was by no means confined to America. A statistical table published in a recent number of the *Moniteur des Intérêts Matériels* furnishes a striking example of this fact. All the larger roads of central Europe show an increase—in many instances a marked one. Those of the Prussian state railroads for the nine months, April-December, have increased receipts from $126,000,000 in 1886 to $135,000,000 in 1887; those of Saxony for the year from $16,000,000 to $17,000,000; those of Baden from $8,700,000 to $9,200,000; and those of Alsace for nine months from a little over $7,500,000 to about $8,000,000. In Austria the increase has been less marked. The state railroads have only a little more than held their own; but the Northern has increased from a little over $9,000,000 to nearly $10,000,000, and some of the other private lines have done about as well in proportion. In Italy the year has been a very successful one, the Mediterranean Company having increased its receipts from $11,000,000 to $12,000,000, and the Southern from $17,000,000 to more than $18,500,000. In France the advance has been very slight, except perhaps on the state roads; still all the companies except the Orléans show a small increase. The Belgian state roads for the first nine months show an increase from $19,000,000 to $20,000,000, and the private lines have increased in the same proportion. In Switzerland the changes are slight, except on the St. Gothard, which shows an advance of nearly 20 per cent. The reports from Russia are in some respects the most striking of all. Of 17 railroads reporting, only three of the very shortest (two of them on the Austrian frontier) show decreases; while many of them show very large gains. The total amount reported has increased from 119,800,000 roubles (or about $58,000,000) to 137,500,000 roubles (or not quite $67,000,000) in 1887.

Last September the Board of Trade issued a circular to the railroads of the United Kingdom asking information as to the provision made by the various companies for exclusive accommodation in carriages of all classes for ladies traveling alone. The immediate occasion of this circular was an outrage which took place last August in a compartment on one of the trains of the London & Northwestern. Without exception, the companies reply that where such provision is made, women traveling alone seem very reluctant to avail themselves of it. On most of the British roads, even if there are not separate compartments regularly provided, the guards are instructed to use every effort to set apart compartments exclusively for ladies, upon request, and are provided with proper labels to affix to the doors, to indicate that any compartment is so reserved. Nevertheless, it is found that in a very great majority of cases ladies prefer seats in other compartments. The only reason assigned, so far as we have seen, is that these reserved compartments are used by nurses and children. The London & Southwestern, for instance, in a record of six days, covering 201 trains, found that 205 compartments were reserved, containing 1,109 seats, of which but 143 seats were occupied. On the Great Western the experience was pretty much the same, except that it is stated that during the same period, over 5,000 female passengers occupied seats in smoking compartments. Secretary Murphy, of the Waterford & Limerick Railway, after stating that his directors are quite willing to comply with the suggestions of the Board, adds: "I may point out that cases of the nature referred to in your circular are, if not altogether unknown, extremely rare in this country." We can imagine his Irish indignation at the suggestion, and are bound to like his gallant national spirit.

Realism on the stage has made great progress since the days of Mr. Crummle's celebrated pump. Real waterfalls, real hansom cabs, and real elephants laden with a ton of real ham sandwiches, have all in turn been placed upon the stage to the admiration of an astonished public. A real locomotive hauling real cars over real rails and switches is, however, a further step towards the introduction of Pike's Peak and Niagara on the new theatre about to be built at the future Western metropolis. The only real theatrical locomotive performs on the stage of the Standard Theatre, in London, and drills a train, sounds the whistle, and starts from a station in a life-like manner. The engine and cars are, it is needless to say, very narrow gauge, and the rails and ties are light and easily laid between the acts. The portability of light railroads is thus forcibly shown.

It has been reported that automatic regulators to open the transoms and ventilators in case the car gets too warm are being tried on the Pittsburgh, Fort Wayne & Chicago in connection with a system of continuous heating (presumably the Williames) in which a double line of pipes are used, the steam and condensed water being returned to the tender. This report is untrue, and the only systems of steam heating hitherto tried on the lines of the Pennsylvania Co. are the "Gold," "Wilder" and "Baker" on the New York and Chicago limited express, and the "Erie" steam heater on an accommodation train at Allegheny.

A patent has just been granted to Mr. Henry Lucas, of St. Paul, Minn., for a freight car with a chute leading downward from the floor of the car outward to the side of the car beneath the sill. The opening of the chute can be closed with flap doors which, when not in use, are placed vertically against the side of the car. The chute can also be closed by a sliding valve. An almost precisely similar arrangement has been in use on grain and other cars on the Russian railroads for many years and was illustrated in these columns on May 8, 1885.

Our new monthly contemporary, the *Locomotive Engineer*, continues to amply fulfill the promise of the first issue, and must be congratulated on many practical and interesting articles.

NEW PUBLICATIONS.

I. *The Elasticity and Resistance of the Materials of Engineering.* By Wm. H. Burr, C. E. Second Edition. N. Y.: John Wiley & Sons. 1888. 8vo, pp. xvii., 753. Price, $5.

II. *Mechanics of Materials.* By Irving P. Church, C. E. N. Y.: John Wiley & Sons. 1887. 8vo, pp. xv., 320.

The numerous experiments on the strength of iron, steel, timber, cement, etc., which are continually appearing in the transactions of technical societies, in scientific periodicals and special treatises, offer a rich field to a careful investigator. Prof. Burr has explored this field, and presents the results of his researches in the work, title of which is given above. He has also added much original matter in the form of theoretical discussions relating to the subject under consideration. Prof. Church's work covers essentially the same ground, condensing the results of experiments by giving average values; and he adds some valuable matter in the form of graphical solutions relating to arches and continuous girders.

Both works are devoted principally to statical strains, such as occur in the work of the civil engineer, but Prof. Burr gives good discussions on the collapse of flues and the strength of riveted parts as used in boiler work.

Standards of Length and their Practical Application. Edited by George M. Bond. Published by the Pratt & Whitney Co., Hartford, Conn.

This publication deals very fully with the means employed for the production of standard gauges and screw threads. The manner of obtaining gauges of accurate length by the use of a comparator is very fully described, and the arguments in favor of measuring by sight instead of by touch are set forth in an exhaustive manner. Various reports and lectures on the subject are here embodied in one volume, forming a valuable work of reference on the subject of accurate measurement.

TECHNICAL.

Compressed Air in Railroad Shops.

Since the adoption of the air brake a small compressed air plant is used in many shops, especially in those of the Denver & Rio Grande, at Denver, where Mr. N. W. Sample, Superintendent of Motive Power, uses it extensively and successfully. Three or four ordinary Westinghouse air pumps (generally those just repaired) are located on an iron frame in the machine shop and are run by direct connection from the boilers. Two air drums, as used on the locomotives, are placed in the shop, and a line of pipe is hung overhead the entire length of the shop, with pipes coming down at convenient points and provided with a globe valve and hose connections.

The compressed air drives three small, plain, slide-valve engines mounted on a little truck, having four 8-in. wheels and provided with a handle to facilitate moving from place to place. They are connected to the air system by hose and exhaust into the open air. These engines have a number of different sized pulleys, easily changed, and do all the drilling about boilers, frames, etc., and are used for a thousand purposes where a small, independent power is needed. Pipes and brakes are tested, dirt is blown out of planer slots and drill holes, cylinder boring machines are run, etc., and, when an engine has been rebuilt, her boiler is filled with 60 lbs. of compressed air, and with this she is run out of shop and to yard without fire, smoke or dirt. At the end of the shop a hose is connected to a T in the blower pipe and the draft kept up enough to prevent the cab being blackened with smoke while the fire is being built.

This line of pipe extends through both the roundhouses, and a pipe comes down at every post. The air is always used when firing up dead engines, as it saves time and is conducive of cleanliness.

Underground pipes conduct air through the coach yard and shop and to pits in freight car repair yard using the common hose coupling; when an air brake or any of its parts are repaired, or reported out of repair, the hose is coupled and the brake tested.

The boiler shop and blacksmith shop are also amply provided with air pipes, one of the main features of the boiler shop being the drilling of holes in fire-box, etc, by the air-operated engines and flexible shaft.—*Locomotive Engineer.*

THE SCRAP HEAP.

Engineer's Earnings.

The engineers on most Louisville roads make good pay, as all run on the mileage basis. Engineers who are disposed to work when opportunity presents, average $125 a month, and when business is good an engineer can about gauge his own wages. On one of the roads running into Louisville the passenger engineers make five days in the week, eight hours a day, and receive for their services $31.80 per week, or about $138 per month.

Courteous and Complimentary.

The commonly accepted definition of "insult" clearly needs remodeling, if the following kind reflections of the *National Car Builder* on the report that the Boston & Albany is to apply a buffer brake to its entire freight equipment are to be taken seriously:

"This is a very unwise proceeding, even for a company noted for conducting their business in a short-sighted fashion. We would raise no objection on general principles to the Boston & Albany throwing away their money foolishly; but in this instance we consider their action conveys a slight to an association representing all the leading railroads on the continent; and on this account, what might otherwise pass as an ordinary business transaction becomes a legitimate subject of comment. * * * The question as to the best form of brake for freight cars is still under the investigation of the Master Car-Builders' Association. * * * The Boston & Albany have sent their representatives to the meetings of the Association and by implication indorsed its action, and now they suddenly begin putting on a brake that was not offered for public trial. This action is not only a gross insult to the Master Car-Builders' Association, but * * * an imposition upon every enterprising railroad that they exchange cars with. It may be that the Boston & Albany Railroad Co. expect * * * to cause delay in the general adoption of automatic freight brakes, * * * but we doubt if they will find another respectable company ready to follow their bad example. * * *

"The car repairers will never be likely to get short of work so long as the brake is kept together. Alexander L. Holley used to give as an objection to the Corliss valve gear for locomotives that it gave the farmers along the line too much work collecting scrap. The valve gear justly noted for falling asunder was a simple and apparently durable apparatus compared to the newest buffer-friction brake. * * * In one solitary test made with an electric brake at Burlington last May about a barrowful of broken pieces were deposited on the track. This Boston & Albany brake is an article of the same kidney, only lacking the electricity and having many more parts. * * * Two leading claims made for this brake are simplicity of construction and cheapness. If the mechanism is simple, preserve all railroads from anything that would be called even a little complex. The brake belies its appearance, or the cost of maintenance will annually be sufficient to make it dear at any price. * * * In short, the devices are inefficient, inconvenient and the claim for cheapness of application is swallowed in the cost of repairs. The parties who are responsible for putting this brake upon the Boston & Albany Railroad have erected a monument to their own imbecility. They ought now to retire with their laurels, for few such opportunities of stupendous blundering come round in a lifetime."

Heavy Damages.

A verdict of $27,000 against the Boston & Albany has been returned by a jury at Boston in the suit of Aloysius Fagnault for a broken leg caused by the fall of a street crossing sign post at Springfield. On May 26, 1886, in a large crowd attending a celebration a number of men leaned against the post, which was rotten, causing it to break and fall upon the plaintiff, a boy of 12 years. The leg had to be amputated. The road admitted its liability, but disputed the amount. The chief question at issue was whether the boy could wear an artificial leg or not.

RAILROAD LAW—NOTES OF DECISIONS.

Powers, Liabilities and Regulation of Railroads.

The Illinois Constitution contains a provision that "a majority of the directors of any railroad corporation now incorporated or hereafter to be incorporated by the laws of this state shall be citizens and residents of this state." The Supreme Court has just decided that this provision does not apply to corporations which are organized under the laws of several states, among them the state of Illinois. Therefore, when the Ohio & Mississippi Railroad, in 1867, consolidated by the laws of Illinois and similar laws in the states of Indiana and Ohio, with the Ohio & Mississippi Railway Co.,

owning and operating a railroad leading from the Mississippi River at East St. Louis, Illinois, to Cincinnati, Ohio, it became a new corporation, existing by virtue of the act of consolidation, under the sanction and by the authority of the three several states in which the constituent companies had been chartered, while its corporate privileges, powers, and obligations within the state of Illinois were prescribed and limited by the charter of the Illinois corporation entering into the consolidation. While therefore in a sense it may be said that the Ohio & Mississippi Railway Co. is incorporated under the laws of this state, it must also be said it exists by virtue of the laws of the states of Illinois, Indiana and Ohio, authorizing and consenting to its organization. The constitutional provision does not embrace the consolidated road. [1]

In Indiana the Supreme Court decides that while operating its railroad which extends from a point in Indiana to the northern lakes in the state of Michigan, the defendant negligently and wrongfully caused the death of the plaintiff's intestate, while the latter was engaged in his line of duty in coupling cars in the state of Michigan, the intestate being at the time an employé of the defendant, and the liability is rested upon a statute of Michigan, not essentially dissimilar to that regulating the same subject in this state, the action may be maintained within the jurisdiction of the courts of Indiana within which the defendant is found.[2]

In Missouri it is held that under the statutes of that state damages can be recovered by a parent for the negligent killing of a *minor* child only, and the measure of damages, in the absence of circumstances calling for punitive damages, is the pecuniary benefit the parent could hope to derive from the child during its minority. It was therefore decided that a verdict awarding plaintiff $5,000 damages for negligence causing the death of a son 18 years old in the employ of a railroad as brakeman, no circumstances of aggravation existing, was excessive.[3]

In Kentucky it is held that the engineer in charge of the construction of a railroad has no power or authority to modify the written contract entered into by the owners for the building of the road.[4]

In Minnesota the charter of a railroad provided for the payment to the state of a stated percentage of its gross earnings, in lieu of all taxes and assessments, and that, in consideration of such payment, the company should be forever exempt from all assessments and taxes whatever upon its stock, franchises or estate, real, personal or mixed. The Supreme Court holds that such exemption was not applicable to large tracts of timber land purchased by the corporation, from which to take timber to be converted into ties and lumber for the use of the corporation.[5]

Under the Nebraska constitution no foreign railroad corporation doing business in that state can exercise the right of eminent domain or have the power to acquire rights of way over real estate for a depot or other uses, unless it organize as a corporation under the laws of the state. The C., B. & Q. Co. and the L. & N. W. R. Co. were joined as relators in an application for *mandamus* to compel the proper authorities to condemn and convey certain lots belonging to the state. The Supreme Court rules that the C., B. & Q. Co., being a foreign corporation, was not entitled to the relief, and, as a foreign corporation, is prohibited from acquiring a right of way or real estate for depots or other uses. Therefore it cannot do indirectly what it is prohibited from doing directly.[6]

Injuries to Passengers, Employes and Strangers.

In Texas a female passenger in attempting to board a car at the station just as the train started fell and was injured. The cause of the fall was because the steps of the car were so high above the platform that the passenger could not recover her balance at the first jolt of the car. It appeared that the lowest step was 4 ft. from the platform. It was contended that there was no negligence in having a short step to a car, but the Supreme Court ruled otherwise and affirms a verdict for $10,000 damages against the railroad.[7]

In the same case it is held that to delay opening the office for the sale of tickets at the station until near the time of starting is negligence.[8]

In Massachusetts the Supreme Judicial Court rules that a coupon ticket book containing notice that the coupons are to be detached by or in the presence of the conductor, and will be accepted for passage only when accompanied by the ticket, is a contract, the conditions of which are not waived by the conductors sometimes allowing passengers to pay their fares with coupons without showing their books.[9]

In Kansas a freight conductor while engaged in his duties on top of a car, and while the train was passing through a bridge, collided with the overhead timbers, some of the braces of which were not sufficiently high to clear a man's head when standing erect on the top of an ordinary car, and thereby suffered injuries. The Supreme Court holds that the company having knowledge, and the conductor not knowing nor having reasonable opportunity to know of the defect, a liability arises against the company, and in favor of the conductor, for the injuries sustained. Although the conductor had passed over the bridge daily for three months, he stated that he did not know of the dangerous proximity of the braces to the top of the cars, to which position his duties seldom called him; that he had only ridden on top of the cars but once prior to the accident; and it being shown that a person could stand on one part of the roof of a car with safety, while, if standing on another part, he would collide with the braces of the bridge; and it being further shown to be very difficult to determine with accuracy the distance between the top of a moving car and the overhead timbers of the bridge The Supreme Court rule that the conductor was not negligent.[10]

In Kentucky a deaf mute was walking on a railroad track where he had no right to be, and was run over by a train. The engineer could have seen him in time to stop the train, and the signal of blowing the whistle and ringing the bell was made. The Court of Appeals decides that the engineer had a right to presume that the deceased would abandon the track for his own safety, and that his death was the result of his own negligence in going upon the track.[11]

In the same state, a street car passing a railroad crossing at night, was run into by a train, and the plaintiff, a passenger on the street car, received injuries. The scene of the accident was in the midst of a dense population, and no flagman was present, though one was required to be kept there by an ordinance of the municipality, and the driver of the street car attempted to cross in front of the train after discovering it. The Court of Appeals holds that both the railroad company and the street car company were guilty of negligence and liable to plaintiff.[12]

In the same state a man was walking on a track and as a train approaching him whistled to indicate that it would stop at the station near by, he went upon the side track. The switch was not closed at that time, but as the train passed the switch it switched off a car, and the switch was closed, and the car ran upon it by its own momentum. The engineer endeavored, by whistling and shouting, to attract the man's attention to the detached car. The conductor left the brake on the detached car, and ran forward to shout at the man, but failed to make him hear, and before he could regain the brake and stop the car he was struck. The Court of Appeals rule that the railroad was negligent and must answer.[13]

In Indiana the Supreme Court rules that while on the one hand a person has a right to go on the track of a railroad at a public crossing, yet those operating a train upon the road are under no obligations to slacken the speed of such train or to bring the same to a stop, when they notice a person crossing or about to cross the track at its intersection with the highway, but they may presume that such person will himself take all proper precautions to avoid injury.[14]

[1] O. & M. R. Co. v. Hanna, 12 West Rep., 601.
[2] Burns v. Grand Rapids & R. Co., 12 West. Rep., 688.
[3] Parsons v. Mo. Pac. R. Co., 6 S. W. Rep., 464.
[4] Campbell v. Cinn. South. R. Co., 6 S. W. Rep., 337.
[5] County of Todd v. St. P. M. & M. R. Co., 36 N. W. Rep., 109.
[6] State v. Scott, 36 N. W. Rep., 121.
[7] Gulf, G. & S. F. R. Co. v. Fox, 6 S. W. Rep., 569.
[8] Idem.
[9] B. & M. R. Co. v. Chipman, 5 New Eng. Rep., 572.
[10] St. L., Ft. S. & W. R. Co. v. Irwin, 16 Pac. Rep., 146.
[11] Nichols v. L. & N. R. Co., 6 S. W. Rep., 339.
[12] Cent. Pass. R. Co. v. Kunn, 6 S. W. Rep., 442.
[13] L. & N. R. Co. v. Colman, 6 S. W. Rep., 439.
[14] O. & M. R. Co. v. Walker, 12 West. Rep., 731.

General Railroad News.

MEETINGS AND ANNOUNCEMENTS.

Meetings.

Meetings of the stockholders of railroad companies will be held as follows:

Atlanta & Charlotte Air Line, annual meeting, New York, March 14.

Chesapeake & Ohio, annual meeting, Richmond, Va., March 15.

Chicago, St. Louis & Pittsburgh, annual meeting, Indianapolis, Ind., March 21.

Colorado Midland, annual meeting, Colorado Springs, Col., April 2.

Georgetown & Western, annual meeting, Charleston, S. C., March 13.

Georgia Pacific, special meeting, Birmingham, Ala., March 31.

Illinois Central, annual meeting, Chicago, Ill., March 14.

Louisville, New Albany & Chicago, annual meeting, New York, March 14.

Missouri Pacific, annual meeting, St. Louis, Mo., March 13.

Nashville, Chattanooga & St. Louis, special meeting, March 21.

Pennsylvania, annual meeting, Philadephia, Pa., March 13.

Rome, Watertown & Ogdensburg Terminal, special meeting, New York, March 12.

St. Louis, Iron Mountain & Southern, annual meeting, St. Louis, Mo., March 13.

Wabash Western, annual meeting, St. Louis, Mo., March 13.

Western New York & Pennsylvania, special meeting, Philadelphia, Pa., March 27.

Wheeling & Lake Erie, special meeting, Toledo, O., March 22.

Washington County, special meeting, New York, March 19.

Dividends.

Dividends on the capital stocks of railroad companies have been declared as follows:

Atlanta & Charlotte Air Line, semi-annual, 2½ per cent., payable March 6.

Chicago & Northwestern, quarterly, 1¾ per cent, on preferred stock, payable March 12.

Railroad and Technical Conventions.

Meetings and conventions of railroad associations and technical societies will be held as follows:

The *General Time Convention*, spring meeting, will be held in New York, April 11.

The *National Association of General Passenger and Ticket Agents* holds its annual meeting in St. Augustine, Fla., on March 20.

The *Master Car-Builders' Association*, annual convention, Alexandria Bay, N. Y., commencing June 12.

The *American Railway Master Mechanics' Association*, next annual convention, Thousand Islands, N. Y., June 19.

The *New England Railroad Club* meets at its rooms in the Boston & Albany passenger station, Boston, on the second Wednesday of each month.

The *New York Railroad Club* meets at its rooms, 113 Liberty street, New York City, on the third Thursday of each month.

The Western Railway Club meets in Chicago the third Wednesday in each month.

The *Central Railway Club* meets at the Tifft House, Buffalo, the fourth Wednesday of January, March, May, August and October.

The *American Society of Civil Engineers* holds meetings on the first and third Wednesday in each month at the House of the Society, 127 East Twenty-third street, New York.

The *Boston Society of Civil Engineers* holds its regular monthly meetings at its rooms in the Boston & Albany station, Boston, at 7:30 p. m. on the third Wednesday of each month.

The *Western Society of Engineers* holds its regular meetings at its hall, No. 15 Washington street, Chicago, at 7:30 p. m., on the first Tuesday of each month.

The *Engineers' Club of St. Louis* meets the first and third Wednesday of each month till June.

The *Engineers' Society of Western Pennsylvania* meets in Pittsburgh the third Tuesday of each month.

PERSONAL.

—Col. William M. Rogers, Assistant to President Alexander, of the Central of Georgia, has resigned.

—Mr. Wm. H. Morrow, for many years connected with the Baldwin Locomotive Works, died at Philadelphia on the 20th ult.

—Major William Ludlow, U. S. A., late Engineer Commissioner of the District of Columbia, is now Engineer of the Fourth Lighthouse District, and will be stationed at Philadelphia.

William A. Baldwin, Manager of the Pennsylvania Co.'s lines, has tendered his resignation to take effect March 22, and, as stated in another column, will become Vice-President of the Buffalo, Rochester & Pittsburgh. He is 52 years of age, and in the 37 years in which he has been in railroad service has had a very extensive experience, having been engaged in the construction of several new roads previous to his connection with the Pennsylvania. He has been connected with the Pennsylvania lines since 1858, and was appointed to his present position in May, 1882.

—The funeral of Mr. A. J. Stevens, late General Master Mechanic of the Southern Pacific, took place on Feb. 16, at Sacramento, and was attended by upward of 2,000 employés of the company. The business houses of the city were closed during the hours of the funeral, and the coffin was covered with flowers, including a representation of a locomotive boiler five feet long, composed of blue violets and variegated pansies. The workmen in the machine shop contributed a model locomotive and tender covered with choice flowers, and other friends contributed broken wheels, anvils, steamboats, etc., wrought in flowers. Mr. Stevens was buried in Oaklands Cemetery.

ELECTIONS AND APPOINTMENTS.

Atchison, Topeka & Santa Fe.—That portion of the Eastern Division south of Florence, and of the Middle Division south of Newton and Halstead, Kan., will hereafter constitute the Southern Division. Avery Turner, Mulvane, Kan., is Superintendent. J. H. Scott has been appointed Superintendent of the Western Division, with office at Pueblo, Col., vice C. M. Rathburn.

Atlanta & Florida.—James M. Duggan has been appointed Auditor, and Augustus Shaw Master of Transportation.

Bay City & Battle Creek.—This Michigan road, reported Jan. 18, has organized by electing the following officers: President, A. W. Wright, Ionia; Vice-President, S. O. Fisher; Secretary, S. S. Hulbert, Battle Creek; Treasurer, W. H. Tarsey. The general offices are at Battle Creek. Work will probably commence at once.

Bellaire, Zanesville & Cincinnati.—C. D. McLeod has been appointed Superintendent; with office at Zanesville, Ohio. The office of Trainmaster has been abolished.

Birmingham Mineral.—Z. Hamer has been appointed Superintendent, with headquarters at Birmingham, Ala.

Boston & Maine.—William Smith, Superintendent of Motive Power, office at Boston; D. J. Flanders, General Passenger Agent, and Charles E. Lord, Assistant General Passenger Agent, have had their authority extended over the whole system, including the Boston & Lowell. D. C. Richardson has been appointed Master Car-Builder, with office at Lawrence, Mass.; A. M. Watt, Assistant Master Car-Builder, with office at Salem, and George W. Storer, Assistant General Passenger Agent, with authority over the whole system.

Cairo, Vincennes & Chicago.—C. E. Doyle, Train Master and Superintendent of Telegraph, has been assigned the duties of Superintendent also, J. Caldwell having resigned.

Carolina, Knoxville & Western.—J. B. Humbert, of Laurens, S. C., has been elected President, vice W. L. Mauldin resigned. J. A. Hoyt has been elected a director.

Chesapeake & Ohio.—M. E. Ingalls has been elected President, vice C. P. Huntington. He is also President of the Cincinnati, Indianapolis, St. Louis & Chicago.

Chester Valley.—The following officers have been elected: President, Austin Corbin; directors, Daniel A. Bennett, George DeB. Keim, A. J. Angelo, A. A. McLeod, W. R. Taylor and O. H. O'Brien.

Chicago, Hannibal & Springfield.—The following are the officers of this company: Roland C. Nickerson, President; Robert D. Fowler, Vice-President; Joseph Lathrop, Secretary and Treasurer; Evlyn F. House, Manager; W. E. Williams, Chief Engineer, Mexico, Mo. The general offices are in Chicago.

Chicago, Milwaukee & St. Paul.—C. R. Lewis has been appointed District Passenger Agent vice George W. White resigned, with headquarters at Marion, Ia. His territory will comprise Missouri (except St. Louis, Kansas City and St. Joseph), Iowa (except Council Bluffs), Minnesota and Dakota south of the line of the Southern Minnesota Division.

Chicago, Oquawka & Kansas City.—At the meeting held in Rock Island, Ill., the following directors were elected: J. S. Thompson, V. M. Blanding, H. P. Hull, Potter Skinner and J. H. Harlan. The officers are: President, J. S. Thompson; Vice-President, J. H. Harlan; Secretary and Treasurer, V. M. Blanding.

Chicago, St. Paul, Minneapolis & Omaha.—H. M. Pearce has been appointed First Assistant General Freight Agent and Stanley Proudfit Second Assistant General Freight Agent.

Cincinnati, New Orleans & Texas Pacific.—I. Quinlan has been appointed General Advertising Agent, with headquarters at Cincinnati, O.

Cleveland, Columbus, Cincinnati & Indianapolis.—At the annual meeting held in Cleveland, O., the following directors were elected for the term of three years: Cornelius Vanderbilt, W. K. Vanderbilt, H. McK. Twombly, Chauncey M. Depew, New York, and Amos Townsend, of Cleveland.

Columbus, Lima & Northwestern.—At the annual meeting held at Lima, O., the following directors were elected: B. C. Faurot, F. L. Langan and D. J. Cable, of Lima, O.; L. K. Stroup, of New Hampshire, O.; William C. Holgate, of Defiance, O.; William Monypenny, P. W. Huntington, L. C. Newson and Charles Parrott, of Columbus. The officers are: B. C. Faurot, President; P. W. Huntington, Vice-President; F. L. Langan, Treasurer; C. O. Hunter, Secretary; and F. D. Cummer, General Manager.

Del Mar & San Diego.—The incorporators of this California company are: George K. Porter, C. Siebe, William H. Carlson and Frank J. Higgins, of San Diego.

Denver & Rio Grande.—D. C. Wilson has been appointed Roadmaster of the first division, with headquarters in Pueblo, Col., vice A. Osborn, resigned.

G. M. Thompson has been appointed Chief Engineer.

Eames Vacuum Brake Company.—Mr. Royal C. Vilas has been appointed Second Vice-President of this company, with headquarters at Boreel Building, 115 Broadway, New York City.

Gainesville & Southwestern.—This Texas company has organized by electing J. M. Lindsey, Gainesville, President, and John T. Walker, Secretary and Treasurer.

Georgia Southern & Florida.—The following are the officers of this company: President, H. J. Lamar; Secretary and Treasurer, R. S. Codins; Chief Engineer, William H. Wells. The general offices are at Macon, Ga.

Indiana Midland.—W. M. Basinger has been appointed Superintendent, with office at Lebanon, Ind.

Kansas City, Arkansas & New Orleans.—The following are the officers of this company: George M. Barbour, President, Beebe, Ark.; Adolph Cudell, General Manager, Chicago, Ill.; Joseph Fleishman, Treasurer, Chicago; Edmund Lehmann, Secretary, Chicago; W. R. Bergholz, Chief Engineer, New York City.

Lehigh Valley.—William B. Smith has been appointed General Eastern Agent, with office in New York, vice C. H. Cummings resigned.

Long Beach.—This Massachusetts company has organized with the following officers: Morris Fitch, President; Henry N. Woods, Treasurer; Thomas Hodge, F. W. Homans, David S. Presson, Morris Fitch and Henry N. Woods, directors.

Macon & Covington.—A. J. McEvoy has been appointed Superintendent.

Milwaukee, Lake Shore & Western.—The following appointments have been made, to take effect March 15: Norman M. Breeze, Northwestern Passenger Agent, Milwaukee, Wis.; C. P. Kennedy, Southern Passenger Agent, Cincinnati, Ohio; William F. Herman, Eastern Passenger Agent, Buffalo, N. Y.; A. W. Russell, Western Passenger Agent, St. Louis, Mo.

Mississippi Southern.—The incorporators of this Mississippi company are T. G. Stuart, J. N. Stuart, G. C. Blackburn, W. S. Wyman, J. C. Turner, E. F. Hunt, G. W. Carlisle, Douglass Green, J. Proctor Knott, J. N. Mulligan, A. W. Hamilton, W. N. Holdman, J. R. Hindman, W. J. Hendrick, W. M. Barker, N. N. Witherspoon, John S. Williams, Y. E. Allison, M. C. Alford, G. M. Gurney, W. D. Hill, R. M. Mulford and S. Duncan Marshall.

Missouri Pacific.—W. H. Boyd has been appointed Superintendent of the lines from Longview to Galveston and Taylor, Tex. The office of Superintendent of all lines in Texas has been abolished.

Nashville & Charleston.—The following are the officers of this company: President, W. L. Breyfogle, Louisville, Ky.; Secretary and Treasurer, George B. Cowlan, Knoxville, Tenn.; Chief Engineer, William H. Case, Knoxville, Tenn.

New York & New England.—The official announcement of the appointment of Edward P. Vining as Traffic Manager has been made.

New York & Ohio.—The following officers and directors of this new Ohio company have been elected: D. M. Yeomans, 35 Wall street, New York, President; Horace Scott, Louisville, Ky., Vice-President; Allen Jones, Kinsman, Ohio, Treasurer; Edwin M. Yeomans, Kinsman, Ohio, Secretary. Directors: D. M. Yeomans, Horace Scott, Allen Jones, H. L. Burnham, E. M. Yeomans.

Omaha, Garden City & Pacific.—The incorporators of this Kansas company are: Hill P. Wilson, of Hayes City; John Ballinger, Geo. E. Morgan, A. P. Toombs, N. D. Pickering, W. W. Wallace, E. C. Gibson, A. H. Adkinson, C. W. Aldrich, Garden City.

Peoria, Decatur & Evansville.—At the annual meeting on March 6 F. Roosevelt, H. I. Nicholas, Edward Brandon and J. H. Mooney were elected directors.

Philadelphia & Reading.—Charles M. Heald has been appointed General Freight Agent vice James Calhoun, and A. H. O'Brien Assistant to the General Manager. The office of General Traffic Manager has been abolished.

St. Paul, Minneapolis & Manitoba.—The Department of Express Traffic has been created, and W. J. Footner, lately holding a similar position on the Northern Pacific, has been appointed manager of it.

St. Paul, New Ulm & Southwestern.—W. C. Bredenhagen, of Carver, Minn., is the President of this company, and W. S. Timberlake, St. Paul, Minn., Treasurer.

San Antonio & Aransas Pass.—E. H. Sabin has been appointed Land Commissioner.

Spokane Falls & Idaho.—The following officers and directors have been elected: Robert Harris, President; J. M. Buckley, Vice-President; George S. Baxter, Treasurer; H. S. Huson, Chief Engineer: A. A. Newbery, Secretary. Directors: A. M. Cannon, J. M. Buckley, F. P. Weymouth, H. S. Huson, Paul Schultze, A. A. Newbery and Robert Harris.

Spokane & Palouse.—The following directors have been elected: A. M. Cannon, J. M. Buckley, H. S. Huson, F. P. Weymouth, J. H. Mitchell, Jr., Paul Schultze and A. A. Newbery. The following officers have been elected: President, A. M. Cannon; Vice-President, J. M. Buckley; Chief Engineer, H. S. Huson; Treasurer, George S. Baxter; Secretary, A. A. Newbery.

Springfield & Columbus.—Among the incorporators of this Ohio company are Oscar Martin, W. H. Van Tassell, D. H. Roche and Clarence Hillary, of Springfield, O.

Union Pacific.—C. H. Smith has been appointed a Land Commissoner of this company.

Vincennes, Oakland City & Owensboro.—The following is a list of officers of this company: J. C. Rudd, President; Edward Watson, Vice-President; C. W. Bransford, Secretary; W. A. Oliphant, Treasurer; J. B. Cockrum, General Solicitor. The general offices are at Owensboro, Ky.

Warrior Coal Fields.—Col. N. B. Lord, New York, is President of this Alabama company, and Col. W. W. Hungerford, Meridian, Miss., is Chief Engineer.

West Jersey.—At the annual meeting held in Camden, N. J., this week the following officers and directors were elected: President, George B. Roberts; Vice-President, William G. Sewell; Secretary and Treasurer, William G. Taylor; Directors, Coleman F. Leaming, Charles E. Elmer, Thomas H. Dudley, George Wood, J. N. Du Barry, N. Parker Shortridge, Edmund Smith, H. D. Welsh, B. F. Lee, James H. Nixon, Josiah Wister and David B. Gill.

West Jersey & Atlantic.—The following directors and officers were elected at the annual meeting held this week. Directors, George Wood, W. J. Sewell, Aaron Fries, Mablon Hutchinson, Samuel G. Lewis, Benjamin F. Lee, John M. Moore, George C. Potts, William C. Scull, Walter Wood, Joseph N. DuBarry, Israel S. Adams and John J. Gardner. Officers: President, George Wood; Vice-President, W. J. Sewell; Secretary and Treasurer, William Taylor.

West Virginia, Pineville & Tennessee.—The following are the projectors of this Kentucky company: P. B. Reed, J. S. Ray, J. D. Reed, Wilkins D. Anderson, Jno. M. Sharp, Jos. Eakins, John H. Whallen, James G. Givens and Thomas Anderson, of Lousville, and M. J. Bailey, of Bell.

OLD AND NEW ROADS.

New Companies Organized.—Bay City & Battle Creek.—Eastern Central.—Del Mar & San Diego.—Mississippi Southern.—Omaha, Garden City & Pacific.—St. Paul, New Ulm & Southwestern.—Springfield & Columbus.—White & Black River Valley.

Arkansas, Kansas & Colorado.—It is stated that the contract has been let for building this branch of the Chicago, Kansas & Nebraska from Dodge City, Kan., the present terminus, northwest to Pueblo, Col., following the south side of the Arkansas River. This would parallel the Atchison, Topeka & Santa Fe.

Atchison, Topeka & Santa Fe.—A San Francisco dispatch states that a large tract of land at Dumbarton Point and along the southern end of San Francisco Bay has been purchased by this company. The location is said to be the only point on the eastern shore of the bay accessible to large steamers. The purchase aggregates 19,000 acres and the price is said to be $677,000. It is taken as a sure indication of the early completion of the Atchison's line from Mojave to San Francisco, on which some work has been done.

Atlanta & Florida.—The track has been completed to the line of the Georgia Midland at a point about 45 miles from Atlanta, Ga., and 14 miles from Wolseyville, to which point it is in operation.

Birmingham Mineral.—A mortgage for $6,250,000 in favor of the Farmers' Loan & Improvement Co., of New York, has been filed in Alabama by this company to secure the completion of its road. The road runs through the southern part of Marshall County, crossing the Tennessee River at Deposit, and continuing on to Huntsville.

Regular freight trains commenced running between Bessemer and Eusley City on the 5th inst. Passenger trais will be put on shortly.

The Pioneer branch to Gothite has been completed. The Blue Creek extension to Blocton and the Gate City extension will be completed within 30 days.

Blackville, Newberry & Alston.—This road will be bonded for $5,000 per mile. Fifty-six-lb. steel rails have been used and 2 Rogers locomotives and 2 passenger cars have been purchased. The contract for grading the road from Sally's to Sievern, S. C., has been let to J. L. Jervey, Summerville, S. C., and will be completed about June 1

Buffalo, Rochester & Pittsburgh.—Repair shops and a roundhouse will be built by this company at Bradford, Pa., and offices for the Superintendent of Motive Power, whose headquarters will be removed from Rochester to Bradford.

Canada Southern.—The Canada Southern wish to protect their most important railroad crossings with interlocking signals, and will probably do so if the Dominion Government will then permit the usual stop to be dispensed with.

Cape Fear & Yadkin Valley.—The city of Wilmington, N. C., has voted $150,000 to aid this road in building to that city from Fayetteville, N. C., and the survey for the permanent location will be commenced in a few days by Mr. Roger Atkinson.

Carolina, Knoxville & Western.—The grading contract from Greenville, S. C., east to the North Carolina state line has been awarded to Tanner & Co., of Cowpens, S. C.

Cedar Falls & Minnesota.—Messrs. Jessup and Forrest, trustees, have filed in the United States Circuit Court at Chicago a bill in equity praying that the Illinois Central be compelled to continue operating the road and to make an accounting.

Central of Georgia.—A surveying party will soon make a survey for an extension from Columbus to a connection with the Southwestern at Americus, Ga.

Charlotte & Weldon.—This road is projected to extend from Charlotte, N. C., northeast through the counties of Cabarrus and Stanley to Troy in Montgomery County, thence through Durham or Raleigh to Louisburg in Franklin County and through Halifax County to Weldon, N. C.

Chattanooga, Rome & Columbus.—John Harrison, Rome, Ga., has contracted to build the second 20-mile section of this road.

Chester Valley.—A plan of reorganization has been formed which provides for the issue of bonds to the amount of $500,000, four-fifths of which will bear interest at the rate of five per cent., and the remaining one-fifth at four per cent. Preferred stock to the amount of $250,000 will be issued, the dividends on which are not to exceed five per cent., and there will also be an issue of common stock to the amount of $550,000.

Chicago, Hannibal & Springfield.—The route of this road is from Chicago to Springfield, Mo., via Hannibal, Mexico, or Centralia, Columbia, crossing the Missouri River at Wolf's Point, Tipton or California, crossing the Osage River at Duroc, and running south via Buffalo to Springfield. The preliminary surveys in Missouri are nearly completed and the line located for two-thirds of the distance in that state. The road in Missouri will pass through 13 counties with a population of about 400,000 and a town and city population of over 60,000.

Chicago, Lodi & Southeastern.—The directors of this projected road have decided to purchase 39 miles of the towpath of the old Wabash & Erie Canal, and the transfer will be made March 13. It will be paid for in stock of the railroad company. The road is projected to extend from Covington, Ind., through Lodi to Terre Haute, with a branch from Lodi, through Rockville to Brazil, and passes through valuable coal fields. Thomas N. Rice, Rockville, Ind., is President.

Cincinnati, New Orleans & Texas Pacific.—The company has decided to rebuild its shops upon the site of those recently destroyed at Ludlow, Ky., and work will begin at once.

Cleveland & Canton.—This road has purchased the Canton & Waynesburg, which extends from Canton, O., to Marks, 5 miles, for $155,000, including a valuable coal franchise, and will extend the road 6 miles to Waynesburg.

Columbus & Western.—A branch road to Bessemer, Ala., will be built as soon as the road is completed to Birmingham. The road is a branch of the Central of Georgia.

Del Mar & San Diego.—Articles of incorporation filed in California to build a road between San Diego and Del Mar in San Diego County. The capital stock is $200,000, of which 10 per cent has been subscribed.

Denver & Rio Grande.—The third rail has been completed as far as Trinidad, Col.

Eastern Central.—The stockholders of the proposed Galion, Logansport & Chicago and the Eastern Central have ratified the action of the directors in consolidating the two companies. The road will be known hereafter under the above name. The route extends from a connection with the Pittsburgh, Cincinnati & St. Louis at Bowerston, O., to La Fayette, Ind., with a branch from Galion, O., to Hillsdale, Mich.

East Tennessee, Virginia & Georgia.—The engineers surveying the extension of this road from Sterling, Ga., and about 12 miles west of Brunswick, south to Jacksonville, Fla., have almost reached Hart's Road. The extension will be 42 miles long, and will shorten the distance between Jesup, Ga., and Jacksonville, Fla., 24 miles over the route of the Savannah, Florida & Western, the distance through being only 115 miles.

Fordsville & Cloverport.—A bill is pending in the Kentucky legislature to incorporate this company to build a road from Cloverport to Fordsville. The projectors are residents of Cloverport.

Georgia Southern & Florida.—Twenty-five miles of track have been completed from Macon, Ga., and the work is progressing at the rate of one mile per day when the weather permits. The grading is completed and the ties distributed to within a few miles of Valdosta, 150 miles south of Macon, and the engineers are now finishing the location from that point south to Palatka, Fla., the terminus of the road. T. J. Jarvies is the principal contractor for the first division. It has not yet been decided when the contract for the second division, from Valdosta to Palatka, will be let. The road is being built by the Macon Construction Co., of Macon, Ga., which has a paid-up capital of about $500,000, and is paid in the first mortgage bonds and stock of the railroad company.

Greenville & Selma.—Projected to extend from Greenville, Ala., to Selma. Col. J. B. Stanley, Greenville, is interested.

Jacksonville & Mayport.—This road, extending from Jacksonville to Mayport, Fla., has been completed.

Kansas City, Arkansas & New Orleans.—The final location is now being made for this road, which is projected to extend from Kansas City, Mo., through Beebe, Ark., and Monroe, La., to New Orleans, and it is thought that it may be finished by next May.

Kansas City, Memphis & Birmingham.—The Bessemer branch was completed on March 3, and will be opened for traffic this or next week.

Kansas City, Wyandotte & Northwestern.—A survey will probably be made in the spring to consider the advisability of an extension from Leavenworth, Kan., through Lawrence to Topeka. The road has been completed from Wyandotte, Kan., to Seneca, 116 miles. Newman Erb, Kansas City, Mo., is vice-president and general manager.

Kentucky.—Bills have been introduced in the Legislature to incorporate the following roads: the Licking & Little Sandy; the Mt. Vernon, Tennessee Valley & Jackson, and the Rough Creek.

Lake Erie & Western.—Work has been re-commenced on the extension from Bloomington west to Peoria, about 16 miles. The grading has been completed with the exception of a cut of half a mile.

Lehigh & Eastern.—This road, extending from Tombicken, Luzerne County, Pa., through Stroudsburgh to Matamoras, with its branches, right of way, etc., was sold at Wilkesbarre, Pa., March 3, for $354,000 to Silas W. Newberger, representing Philadelphia people. It is stated that a new company will be formed to construct a road from Sunbury to Port Jervis, about 140 miles, to connect with the Port Jervis, Monticello & New York, and Poughkeepsie Valley, with the intention of making a through route from the coal regions to Boston and Central New England.

Lookout Mountain.—Work has been resumed on this standard gauge road which is being built up Lookout Mountain, at Chattanooga, Tenn. The road is 8 miles in length and is to be in operation by May 1.

Louisville & Nashville.—A Knoxville dispatch states that a force of engineers is in the field surveying a line from Jellico southeast to Knoxville, Tenn., a distance of 65 miles. The line would parallel the road of the East Tennessee, Virginia & Georgia between the two points.

The survey has been completed for a branch from the Helena mines to Woodstock, Ala., about 30 miles, where it will connect with the Birmingham Mineral road. It will pass through one of the Cahaba Valley coal sections.

Louisville, New Albany & Corydon.—This Indiana road will extend its line a distance of five miles to King's Cave.

Louisville Southern.—Tracklaying has been completed from Harrodsburg, Ky., to within about 7 miles of Lawrenceburg.

Marietta & North Georgia.—A branch will probably be built from Marietta, Ga., 17 miles to Austelle. C. R. Walton, Marietta, Ga., is chief engineer.

Mexican International—The station of Torreon, in the state of Coahuila, at which connection is made with the Mexican Central, is 518 miles from Paso del Norte and 707 miles from the City of Mexico, and not 201 and 1,021 miles, respectively, as stated in our last number. From the City of Mexico, via Torreon, to Piedras Negras, on the Rio Grande, is 1,090 miles, and to San Antonio, Tex., 1,258 miles, or but 33 miles further than from the City of Mexico to El Paso. It is reported that the alignment and curvature is very favorable, and that the grade from Piedras Negras to Torreon does not exceed 1 per cent. The elevation of Pedras Negras is 722 ft., and of Torreon 3,721 ft., the highest intermediate point on the road being 3,898 ft. The climatic conditions are therefore desirable. Work on the branch to Saltillo has not yet been commenced. The branch to Lampazos is partly completed and work thereon is progressing. The International road passes through the coal fields of the state of Coahuila, which are being rapidly developed, and it is expected that coal will soon be supplied in large quantity from that locality to the interior of Mexico.

Mexico.—The *Mexican Financier* gives the following information of Mexican railroads: It is reported that a company is being organized at Morelos to build a railroad in the state of Morelos, to connect all the important haciendas, a project which seems to promise good results. This enterprise does not conflict with the plans of the Interoceanic, as the new road would be a very valuable feeder to it. A project is on foot at Corpus Christi, Texas, to build a deep-water pier at Padre Island which would, in the judgment of business men there, give to the National Railway all the advantages of a first-class harbor and enable it to receive freight from the largest Atlantic steamers direct.

Mississippi Southern.—Incorporated in Mississippi to construct a road from Natchez to the Alabama state line with branches.

Missouri Pacific.—The branch road extending from Lexington, Mo., on the branch from Sedalia to Kansas City, and 43 miles from the latter place, has been finished northeast to Marshall, Mo., and will be completed to Boonville, 34 miles northeast of Sedalia, on the line between that city and Hannibal, Mo., in a few weeks.

The branch which leaves Yuma, Kan., on the Central Branch, has been completed from Spencer, 30 miles north of Yuma, to which point it is operated north to Hastings, Neb., on the St. Joseph & Grand Island.

It is stated that this company has secured control of the Lawrence, Emporia & Southwestern, formerly known as the Carbondale branch, and will complete it to Osage City, Kan., where it will connect with the line to Pueblo, Col.

Mobile & Ohio.—The committee of the debenture bondholders has recommended a plan for a readjustment of

bonds so that interest payments can be met. It provides for a new issue of $10,500,000 four per cent. bonds to be exchanged for present outstanding bonds of different classes in varying proportions.

Montgomery & Birmingham.—This road is projected to extend from Montgomery, Ala., to Maplesville, and thence to Briarfield and Birmingham. The tracks of the Selma, Rome & Dalton, East Tennessee, Virginia & Georgia, and Mobile & Birmingham, will be used. Col. Wilson is making a survey from Montgomery to Maplesville, and if his estimates are not greater than those of the company, the East Tennessee & Virginia & Georgia will indorse the bonds of the company. E. S. Chambers is interested in the enterprise.

Mountain View.—A bill is pending in Congress to grant this road the right to cross the Indian reservation near Hot Springs, Ark. It is projected to run from Hot Springs to the summit of the mountains. George W. Baxter is President.

Nashville & Charleston.—The contract for the first section of this road, 46 miles, through the Little Tennessee Pass from Chilhowee Mountain to Bushnell, N. C., on the Western North Carolina, will be let this month, the location being nearly completed. The heaviest grade shown by preliminary survey is 70 ft. per mile.

New Roads.—It is stated that W. D. Forest, of Decatur, Ala., and others will build a road from that place to Moulton Heights.

C. O. Godfrey, Fort Payne, Ala., has had surveys made for a 2-mile road from that place to Fort Payne Springs.

New York & Ohio.—About 30 miles have been graded on this new Ohio road, which is to extend from Hudson, Summit Co., through the counties of Summit, Portage, Geaugo and Trumbull, to Kinsman, at the Pennsylvania state line, a distance of 52 miles. From Kinsman it will be extended to Greenville, Pa. The officers are given in another column.

New York, Ontario & Western.—The company is considering the advisability of tunneling the hill between Sidney and Walton, N. Y., where the road at present makes a detour of about 2 miles.

Northern Pacific.—But 1,300 ft. remain to be bored to complete the Cascade Tunnel, and the work progresses at the rate of about 20 ft. a day.

Work has been resumed on the extension of the Spokane & Palouse.

It is stated that a branch will be built from Sprague, W. T., to Salmon City, Idaho.

Ohio & Northwestern.—About 5 miles of track have been completed from Portland on the extension from that place east to Gallipolis via Olive Furnaces, 56 miles. The rest will probably be built this year, but when has not yet been decided. John D. Letcher, Portsmouth, O., is Chief Engineer.

Omaha, Garden City & Pacific.—Incorporated in Kansas to build a road from the north line of the state, a point near the north boundary line of Jewell or Washington County, running thence in a southwesterly direction through the counties of Washington, Jewell, Smith, Republic, Cloud, Mitchell, Osborn, Lincoln, Russell, Rooks, Ellis, Trego, Rush, Ness, Garfield, Haskell, Grant, Hamilton, Stanton, Morton, Stevens and Hodgeman. The capital stock is $7,000,000.

Ontario, Manitoba & Western.—A bill has been introduced in the Canadian Parliament to incorporate this company to construct a road from Port Arthur to Winnipeg with branches.

Oregon & California.—An effort is being made to induce this road to extend the West Side division, which runs from Portland, Or., 97 miles to Corvallis, from the latter place through the valley of the Long Tom River to its headwaters, thence through a gap in the Siuslaw Mountain to the Siuslaw Valley, then down Pass Creek to Drain, Douglas County, Or., a distance of about 70 miles. Such a road would open up a valuable lumber district.

Oregon Railway & Navigation.—An injunction has been issued restraining the directors from executing the lease of the road to the Northern and Union Pacific companies.

Peninsular, of Lower California.—Engineers have commenced the survey of this road, starting from San Carlos Cañon The road is projected to extend from San Diego to Ensenada, Lower California.

Philadelphia & Reading.—It is reported that the company is buying real estate in Philadelphia on a line from Ninth street diagonally across to Tenth and Willow streets, and thence to Twelfth and Market, where, it has been rumored, a new station will sometime be built.

Pittsburgh & Lake Erie.—Several of the officers of this company, who were discharged pending investigations in the passenger department, have brought suit against the pany for damages, alleging injury to their reputations.

Pontiac, Oxford & Port Austin.—The Farmers' Loan & Trust Co., of New York, has taken possession of this road and all its properties, it having defaulted in payment of its mortgage bonds. James Houston, the Superintendent, has been appointed agent for the trustee, and will continue the operation of the road. The road is 100 miles long, from Pontiac, Mich., to Caseville, via Oxford.

Raritan River.—It is stated that Sidney H. Ripley, of Northampton, Mass., has purchased this road and will soon begin active construction work. It is projected to extend from South Amboy, N. J., through Sayreville and Bound Brook to New Brunswick.

Rio Grande & Utah.—The survey has been completed from Algodones, N. M., to Durango and Rico, Col., about 300 miles. The maximum grade is 80 ft. per mile. It is expected that contracts will be let in the spring. John W. Conley, Chicago, Ill., is President.

Rome & Decatur.—It is stated that the claims against this company have been settled and that tracklaying will commence this week.

St. Augustine & Atlantic Coast Line.—The right of way from St. Augustine, Fla., seven miles to Moultrie, will be secured in 10 days, when grading will be commenced between the two points, and that part of the road is expected to be completed in 90 days. S. J. Fox is General Manager.

St. Louis, Arkansas & Texas.—Is is reported that a survey is being made from Gatesville, Tex., on the Texas Division of this road, 304 miles from Texarkana, southwest to Llano.

St. Louis & San Francisco.—In the suit instituted by Frank B. Stearns to recover $200,000 for alleged breach of a contract for the sale of 8,500 acres of mineral lands in Missouri the Supreme Court rendered a verdict in favor of the plaintiff for $163,000.

St. Paul, Minneapolis & Manitoba.—President Hill has issued a circular to the stockholders giving the plans of the company for the building of extensions, etc., during the coming year. The circular says the Northern Steamship Co., a controlling interest in which is held by the road, is building six large steel steamers to run between Duluth and lower lake ports. * * It is proposed to complete the lines of the Wilmar & Sioux Falls, connecting at Wilmar, and the Duluth, Watertown & Pacific, connecting at Watertown, which, with some new local branches, will aggregate 283 miles to be built. The building of a large terminal elevator is among the improvements to be made. The estimated expense of all this work is $5,000,000 to $6,000,000, and it has been resolved to create a mortgage to secure $8,000,000 bonds, to be secured by depositing with the Central Trust Company of New York $10,000,000 in stocks and bonds of the above named controlled roads and steamship companies, together with $750,000 of the 4½ per cent. consolidated bonds of the St. Paul, Minneapolis & Manitoba. The new bonds will run ten years at 5 per cent., the company reserving the option to redeem at par on three months' notice, after Aug. 1, 1889. Stockholders are entitled to take bonds to the amount of 40 per cent. of their holdings.

The company is to take the management of the express traffic over its lines into its own hands, having engaged Mr. W. J. Footner, the General Superintendent of the Northern Pacific Express, to take charge of the department. The American Express Co. has hitherto operated over this road.

St. Paul, Minneapolis & Manitoba.—Foley Bros., St. Cloud, Minn., have sublet 10 miles of grading on the line from Hinckley to West Superior, Wis., to J. W. Rhodes, of West Superior.

St. Paul, New Ulm & Southwestern.—Organized in Minnesota to build a road from Hopkins, through New Ulm, to Omaha, Neb.

San Francisco, Clear Lake & Humboldt.—The grading on this California road has been completed for a distance of 25 miles, and work is to be vigorously pushed. W. H. Pettibone, San Francisco, Cal., is General Manager.

San Pedro, Los Angeles & Utah.—A mortgage has been filed by this company for the issuance of $1,500,000 bonds with which to complete the first 75 miles of the road. The road is projected to extend from San Pedro Bay, through Los Angeles and Pasadena, thence through the counties of San Bernardino, Kern and Inyo, passing Owen's Lake, to a connection with the proposed line of the Union Pacific near the Nevada line.

Selma & Cahaba Valley.—The contract to build this road is said to have been let to Pearson & Crocker. The survey of the road from Selma to Bessemer, Ala., 65 miles, was completed some time ago, but nothing further done.

Sheffeld, Birmingham Coal, Iron & Railroad.—A mortgage has been made in favor of the Central Trust Co of New York for $1,000,000.

Springfield & Columbus.—Articles of incorporation have been filed in Ohio for the purpose of building a road between Springfield and Columbus, and it is stated that it will be used as an outlet to the latter point for the Indiana, Bloomington & Western. The capital stock is $1,000,000, and it is said to be largely owned by persons interested in the latter road.

Tennessee & Coosa.—It is stated that work will begin immediately on this road, which is to extend from Gadsden, Ala., to Gimtersville, from which place it may be extended to Decatur or Huntsville.

Toledo, Ann Arbor & North Michigan.—The extension from Mount Pleasant northward (the Toledo, Ann Arbor & Cadillac) has been formally consolidated with the parent company.

Vicksburg, Shreveport & Pacific.—The railroad extending from Gibbs, La., on this line 20 miles to Homer, has been completed.

Vincennes, Oakland City & Owensboro.—The contracts for this road will be let in June. The road extends from Vincennes, Ind., through Oakland City, to Owensboro, Ky., and the surveys have all been completed.

Warrior Coal Fields.—This road has been located its entire distance from Meridian, Miss., through the Warrior Coal Fields, to Decatur, Ala., and the contract to Gainesville, Ala., has been let to Dunn Bros., Birmingham, who are now at work.

Washington, Western & Southern.—This company has been formed to build a road from Washington, D. C., to Warrenton, Va., and then possibly further West.

West Virginia, Pineville & Tennessee.—A bill is before the Kentucky Legislature to incorporate a company of this name to construct a road from a point near the mouth of Straight Creek, opposite Pineville, Ky., along Straight Creek, through Bell, Harlan, Leslie, Perry, Letsher and Pike counties, to some point on the state line at or near the breaks of the Big Sandy; also from Pineville through Pine Gap to some terminal point on the Tennessee state line at or near the crossing of Willow Creek.

White & Black River Valley.—Articles of incorporation have been filed in Arkansas by a company of this name to build a road from Jacksonport, the terminus of the Batesville & Brinkley, northeast through the counties of Jackson, Independence, Lawrence and Randolph to a point on the state line between Missouri and Arkansas, about 75 miles. The capital stock is $9,000,000.

Williamstown & Delaware Hill.—The extension of this road will not at present be built beyond Mullica Hill, N. J., about 7 miles from Glassboro, the present terminus. All the right of way for this extension has been secured, with the exception of ¼ mile at Glassboro, which will be condemned by the Commissioners in 10 days. The grading contract has been let to F. H. Thomas, Shippensburg, Pa., and funds for the extension have been provided by an issue of five per cent. general mortgage bonds, which have been taken by B. K. Jamison & Co., of Philadelphia, Pa., and by local subscriptions at par. The road will, in the future, be extended to the Delaware River.

Wilmington, Onslow & East Carolina.—This company has been voted $100,000 by the City of Wilmington, N. C., and grading has been commenced in Pender County, N. C., and will work toward New Berne, passing through Stone Bay and Jacksonville.

TRAFFIC AND EARNINGS.

Coal.

The coal tonnages for the week ending March 3 are reported as follows:

	1888.	1887.	Inc. or Dec.	P. c.
Anthracite	640,203	631.839	I. 8,364	1.3
Bituminous	334,499	285,354	I. 49,145	17.2

The coal tonnages of the Pennsylvania road east of Pittsburgh and Erie, for the week ending March 3, and the year to that date, are as follows:

	Coal.	Coke.	Total.
Total week ending Mar. 3, 1888.	252,098	63,921	316.019
Total year 1888 to date	2,069,005	707,422	2,776,427
Total year 1887 to date	1,751,096	767,568	2 518,664

On the United Railroads of New Jersey Division the tonnages for the same periods were as follows:

	1888.	1887.	Decrease.
Total for week	27,420	32.143	D. 4.723
Total for the year	287,870	306 983	D. 19,113

Railroad Earnings.

Earnings of railroad lines for various periods are reported as follows:

Month of February:	1888.	1887.	Inc. or Dec.	P. c.
Buff., R. & Pitts.	$146,142	$131,727	I. $14 415	10.9
Cairo, V. & Chic.	54,689	50,766	I. 3,923	7.7
Canadian Pac.	816,000	509,000	I. 307,000	60.4
Chi. & Atlantic	151,667	161,340	D. 9.673	6.1
Chi. & East. Ill.	159,200	141,289	I. 17.911	12.7
Chi., Mil. & St. P.	1,577,000	1,524,972	I. 52,028	3.4
Chi. & W. M.	99,523	95,293	I. 4,230	4 4
Den. & R. G.	501,500	540,900	D. 39,400	7.3
Ev. & Indianap.	17.619	17.357	I. 262	1.5
Ev. & Terre H.	67,691	54 534	I. 13,157	23.9
Kings & Pemb.	12,415	7,866	I. 4,549	59.3
Lake E. & W.	146,377	136,793	I. 9,584	7.0
Louisv. & Nashv.	1,266,965	1,170,453	I. 96,512	8.2
L., N. A. & Chi.	149,756	144,020	I. 5,136	3.5
L., N. O. & Tex.	218,345	172,225	I. 46,120	26.8
Mexican Central.	472,000	388,240	I. 83,760	21.3
Mil. & Northern.	69,730	64,886	I. 4.844	7.5
Mobile & Ohio.	207,847	200,498	I. 7,349	3.7
Norfolk & West.	327,941	276,592	I. 51,349	18 4
Northern Pacific.	916,990	525,728	I. 391,262	74 3
Ohio River.	30,800	14,247	I. 16,573	116.4
Pitts. & West	123,067	121,998	I. 1.069	0.9
St. L., A. & T.	222,0.9	175,636	I. 46 393	26.4
St. L. & San F.	391,000	397 000	D. 6,000	1 5
St. P. M. & Man.	555,015	434,810	I. 120,205	27.6
Tol., A.A. & N.M.	44.620	36,712	I. 7,908	21.2
Tol. & O. Cent.	103,004	77,580	I. 25,424	32.8
Wabash West.	350,058	422,323	D. 72,265	17.1
West. N. Y. & P.	219,000	184,200	I. 34,800	18.9
Total	$9,415,990	$8,179,565	I. $1,365,763	16.6
			D. 127,338	....
Net			I. 1,238,425	15.1
Month of January:				
Allegheny Valley.	$155,155	$148,091	I. $7,064	4.7
Net	67,285	45.273	I. 22,012	48.9
Cam. & A. & Br.	32,934	29,843	I. 3,091	10.3
Net	Def. 9,221	Def. 8,452	D. 769	....
Canadian Pac.	801,205	643,493	I. 157,712	24.8
Net	22,286	21,503	I 783	3.8
Cape F. & Y. Vy.	27,920	20,713	I. 7,207	34 2
Net	15,407	10 314	I. 5,093	49.4
Ft. W. & Den. C.	63,503	37,619	I. 25,884	68.8
Net	22,388	14 206	I. 8,182	57.5
Kentucky Cent.	72,709	67,191	I. 5,518	8.2
Net	25,502	23,567	I. 1,936	8.2
Louis & Nash.	1,306,817	1,227,769	I. 79,048	6.4
Net	415,196	440,618	D. 25,422	5.8
Mem. & Charles.	157,940	156,246	I. 19 694	1.1
Net	41,785	24,570	I. 17,215	65.9
N. Y., O. & West.	107,572	90,166	I. 17,406	19.3
Net	3 656	1 844	I. 1.812	98.5
Norfolk & West.	380 801	279.305	I. 101,496	36.4
Net	158,635	102,185	I. 56,450	55.3
Northern Central	452,441	514,948	D. 62,507	12.1
Net	128,247	230,225	D. 101,978	44.3
Ohio & Miss.	304,827	295,219	I. 9,608	3.3
Net	85,503	85,804	D. 301	0.4
Pennsylvania	4,193,979	3,851,771	I. 342,208	8.9
Net	1,005,920	1,214,351	D. 208,431	17.1
Phila. & Erie	223,744	260,052	D. 36,308	14.0
Net	52,146	102,143	D. 49,997	49.0
Phila. & Read.	930,240	1,570 821	D. 640,581	40.8
Net	100,642	725 708	D. 625,066	86 1
C. & I. Co.	332,827	1,037.750	D. 704,923	67.8
Net	Def. 173,655	24.727	D. 197,382	....
Total both co's.	1,263,068	2,608,571	D. 1,345,503	51.6
Net	Def. 73,012	749,435	D. 822,447	....
Pitts. & West.	142,853	153,106	D. 10,253	6.6
Net	39 594	36,354	I. 3,240	8.9
Rome, W. & Og.	212,446	184,576	I. 27,870	15.1
Net	67,891	59,149	I. 8,742	14.8
ShenandoahVal.	51,100	57,288	D. 6,188	10.8
Net	Def 6,340	2,171	D. 8,511	....
Tol. & Ohio Cent.	108,212	85,956	I. 22,256	25.9
Net	43,032	34,349	I. 8,683	25.3
West J. and Br.	85,705	76.8.8	I. 8,877	11.6
Net	1,2 0	24,024	D. 22,804	95.0
W. N. Y. & Pa.	212,750	189,809	I. 22,950	12 1
Net	46,633	Def. 30,253	I. 77,586	....
Total (gross)	$10,157,690	$10,978,560	D. $620,870	5.6
Total (net)	7,153,754	3,182,580	D. 1,240,660	38.8
			I. 211.734	....
Net			D. 1,028,826	22.2

Early reports of monthly earnings are usually estimated in part, and are subject to correction by later statements.

Gen. John McNulta, Receiver of the Wabash, has filed the following report for January.

Receipts.

Balance cash Dec. 31	$334,029
Receipts on accounts prior to April 1, 1887	100
Receipts on current accounts	725,258
Total	$1,059,387

Disbursements.

On accounts prior to April 1, 1887	1,886
On current account	653,474
Deposit for payment of coupons on first mortgage bonds	122,944
Total	$778,304
Balance Jan. 31	$281,083

The New York, New Haven & Hartford report for the quarter ended Dec. 31 is as follows:

	1887.	1886.	Inc. or Dec.	P. c.
Gross earnings	$2,504,593	$1,953,355	I. $551,238	28.4
Operating expenses	1,676,796	1,277,129	I. 399,667	31.3
Net earnings	$827,777	$676,226	I. $151,551	22 4
Other income	9,113	6,143	I. 2,975	49.5
Gross income	$836 890	$682,369	I. 154,521	22.6
Fixed charges	389,425	214,947	I. 174,478	81.1
Net income	$447,465	$467,422	D. 19.957	4.2
Cash on hand	218,434	1.214,243	D. 995,809	....
Profit and loss (surpl's)	3,607,774	2,980,838	D. 626,936	21.0

Cotton.

The cotton movement for the week ending March 4 is reported as follows, in bales:

Interior markets:	1888.	1887.	Inc. or Dec.	P. c.
Receipts	32 410	38.062	D. 5.652	14.
Shipments	58.436	73.270	D. 14,834	20.
Stock	324.588	265,991	I. 58,597	22
Seaports:				
Receipts	65.592	79.951	D. 14,389	17.9
Exports	2,179,243	3,508,188	D. 1,328,945	37.9
Stock	821,639	797,419	I. 24.220	3.1

Traffic Notes

Interest in the rate war in the West has been dampened by the absorbing attention given to the engineers' strike. The Chicago Missouri River roads cut the first and second class rates on Feb. 27 to 20 cents; on the other classes, 11 cents. Consultations in Chicago are in progress, but have reported no results as yet.

Coal rates between Chicago and Council Bluffs have been reduced from $3.22 to $2.20 per ton. The first and second class rates from Chicago to Dubuque are 15 cents.

The Central Traffic Association has reduced fourth, fifth, and sixth classes both east and west bound to the basis 35, 30 and 24, respectively, between New York and Chicago. This is simply taking off the 10 per cent. which was added two months ago.

It is said that at the meeting of the trunk lines in New York, Feb. 29, the roads agreed to discontinue prorating with roads west of Chicago after March 3.

The meeting of the Central Traffic Association to be held in Chicago this week has about thirty different subjects to act upon, including a large share of all the question that are perplexing traffic men in that region at present.

The roads running out of New Orleans have disagreed concerning passenger rates to the north, which have been maintained for a long time through the medium of an association, and it is said slight cuts have been made.

ANNUAL REPORTS.

The following is an index to the annual reports of railroas companies which have been reviewed in previous number of the current volume of the *Railroad Gazette:*

Baltimore & Ohio	48	Norfolk & Western	98
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Chicago & Alton	148	Richmond & Danville	64
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Fitchburg	32	St. Louis, Vandalia & T. Haute	64
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Pennsylvania Railroad.

This company reports for the year ending Dec. 31, 1887

The mileage worked was: Pennsylvania Railroad division, 1,587 miles; United Railroads of N. J. division, 467 miles; Philadelphia & Erie division, 288 miles; all lines east of Pittsburgh and Erie, 2,341 miles. The general balance sheet is not given nor the equipment.

The earnings and expenses were :

PENNSYLVANIA RAILROAD DIVISION.

	1887.	1886.	Increase.	P. c.
Earnings	$35,305,728	$31,132,287	I. $4,173,441	13.4
Expenses	22,328,536	19,149,250	I. 3,179,286	16.6
Net earnings	$12,977,192	$11 933,037	I. 1,044,055	8.8
Gross per mile	22,246	19,865	I. 2,381	11.9
Net per mile	8.177	7,610	I. 567	7.4
Per cent. of exp	63.3	61.5		
Net as above	12,977,192	11,933,037	I. 1,044,055	8 8
Interest, rent of equipment, etc.	5,162,809	4.459.418	I. 703,391	15.8
Total	$18,140.001	$16,442,455	I. $1,697,546	10.4
Rentals, int., etc.	7,698,714	7,467,485	I. 231,229	3.1
Net income P. R. R. Div	$10,441,287	$8,974,970	I. $1,466,317	16.2

UNITED NEW JERSEY DIVISION.

	1887.	1886	Inc. or Dec.	P.c.
Earnings	$16.428,654	$15,538,305	I. $790,349	5 1
Expenses	13,301,001	11,227 813	I. 1,073,188	9.8
Net earnings	4,027,653	4 310.492	D. 282,839	6.6
Gross earn. per mile	34.965	32,915	I. 2,050	6.2
Net earnings per mile	8.625	9.251	D. 626	6.7
Per cent. of exps	75.5	72.4		
Net earnings as aoove	4,027.653	4,310,492	D. 282,839	6 6
Interest	532,102	401.025	I. 131,077	32.8
Total	4,559,755	4,711,517	D. 151,762	3.2
Interest, rentals and dividends	4,787,746	4,890,533	D. 92,787	1.9
Net loss on United New Jersey lease.	227,991	179,016	I. 48,975	27.4

PHILADELPHIA & ERIE DIVISION.

	1887.	1886.	Inc. or Dec.	P. c.
Earnings	$4,036.931	$3,708,485	I. $328,446	8.9
Expenses	2,457,048	2,242,532	I. 214,516	9.6
Net earnings	$1,579,884	$1,465,953	I. $113,931	7.8
Gross earn. per mile.	14,017	12.877	I. 1,140	8.8
Net " "	5.486	5 090	I. 396	7.8
Per cent. of expe	61.2	60.3		
Net earn. as above.	1,579,884	1,465,953	I. 113,931	7.8
Interest for use of equipment	167,341	201,696	D. 34,355	17.2
Net payable to P. & E. as rental	$1,412,542	$1,264,257	I. $148,285	11.8

The earnings and expenses of all lines east of Pittsburgh and Erie were :

	Earnings.	Expenses.	Rental and interest on equipment.	Net earnings.
1887	$55,671,313	$37,086,585	$4,699,211	$13,885,517
1886	50,379,077	32,619,595	4,453,746	13,305,737
Increase	$5,292,236	$4,466 990	$245,465	$579,781

	1887.	1886.	Increase.	P c.
Gross earn. per mile	23.781	21,696	I. 2,08	9.7
Net " "	5,931	5,730	I. 201	3.5

The gross earnings per mile received from the main line (358 miles) in 1887 were $76,626
In 1886 68,084
Increase 8,541

The percentage of operating expenses to earnings on all lines east of Pittsburgh and Erie was 66.62 for 1887, and 64.75 for 1886, showing an increase for the year 1887 of 1.87 per cent.

GENERAL INCOME ACCOUNT.

Net income Pennsylvania Railroad		$10,441,287
Net loss New Jersey Division		227,991
Net balance		$10,213,296
Payment to fund for purchase of securities	$78,624	
Consolidated mortgage sinking fund	324.800	
Allegheny Valley deficit on guarantees	352,835	
American Steamship Co. interest, etc	90,000	
Ditto settlement of balances under Trunk Line pool	167,183	
Ditto balance due on account of liability for the destruction of private property by fire	175,000	
Amount expended in extraordinary repairs and improvements, not properly chargeable to capital account	1.241.115	
Dividend of 5½ per cent	5,418,702	
		$7,848,259
Balance		2,365,037
Charged off in settlement of sundry accounts		381,438
Profit and loss for the year 1887	$ 1,983,590	
Profit and loss December 31, 1886	15,625,348	
Balance to credit of profit and loss December 31, 1287		$17,608,948

LINES WEST OF PITTSBURGH.

The following statement gives the result of the lines west of Pittsburgh operated by the Pennsylvania Co. and Pittsburgh, Cincinnati & St. Louis Co.:

Total earnings of the Pennsylvania Co. on lines operated directly	$20,784,403	
Expenses	12,859,424	
Net earnings	$7,924,980	
From this deduct: Rental, interest and liabilities chargeable	7,249,464	
Net profit on Pennsylvania Co.'s lines		$675.516
Earnings of the Pittsburgh, Cincinnati & St. Louis on lines operated directly	$8,286,254	
Expenses	5,859,199	
Net earnings	$2,427,055	
Rental, interest and liabilities chargeable thereto	1,902,385	
Profit on Pittsburgh, Cincinnati & St. Louis Railway Co.'s lines		$524.670
Net profit on lines west of Pittsburgh for 1887		$1.200,186
Net profit on lines west of Pittsburgh for 1886		182,450
Gain on lines west of Pittsburgh for 1887		$1,017,736

The other lines west of Pittsburgh, on account of which your company has assumed direct obligations, or in which it is largely interested through ownership of securities, but which are operated through their own organizations, are the Chicago, St. Louis & Pittsburgh; St. Louis, Vandalia & Terre Haute; Grand Rapids & Indiana, and roads operated through its organization; East St. Louis & Carondelet; Cincinnati and Muskingum Valley, and the Waynesburg & Washington. The earnings were:

Gross earnings	$11,253.841	
Expenses	7,913,035	
Net earnings	$3.340.806	
Rental and interest	3,184,251	
Profit		$156,554
Profit to the company under existing contracts		78,277
Profit shown in the above statement		1,200.186
Net profit on all lines west of Pittsburgh for 1887		$1,278,463
Net profit on all lines west of Pittsburgh for 1886		205.787
A gain for 1887, as compared with 1886		$1,072,676

The following tables show the gross earnings, expenses and net earnings of the coal companies for 1887, as compared with 1886, and also the amount of coal mined and sold, and the price received for the same at point of sale:

	Earnings. 1887.	Expenses (including taxes). 1887.	Net earnings. 1887.
Totals	$8,820,719	$7,976,370	$844,348
Increase as compared with previous year	1,377,638	442,437	935,201

Total tons mined in 1887, 2,326,053.19. Increase, compared with previous year, 53,215.08 tons.

The average price per ton at point of sale, aggregating the results of the four coal companies for 1887, was $3.594 per ton, as against $3.1412 in 1886; an increase of 45.28 cents per ton.

SUMMARY OF LINES OWNED OR CONTROLLED EAST AND WEST OF PITTSBURGH.

	1887.	1886.	Increase.
Gross earnings from traffic	$115,515,506	$101,697,981	$13,817,525
Gross exp. ex. rentals, int'r'st, divid'nds, etc.	77,238,082	67,102,715	10,135,368
Showing net earnings	$38,277,424	$34,595,266	$3,682,158

Freight Traffic.

	1887. Tons.	1887. Tons 1 mile.	1886. Tons.	1886. Tons 1 mile.
Lines east of Pittsburgh and Erie	72,356,095	6,415,642,576	64,471,950	5,691,216,707
Lines west of Pittsburgh	33,772,120	3,506,424,458	32,297,431	2.999,627,781
Totals	106,128,215	9.922,067,034	96,769,381	8,690,844,488

Passenger Traffic.

	1887. Passengers.	1887. Passengers. 1 mile.	1886. Passengers.	1886. Passengers. 1 mile.
Lines east of Pittsburgh and Erie	54.733,927	1,014,127 707	48,115,298	902,432,455
Lines west of Pittsburgh	13,419,778	368,645,197	12,350,940	326,793,190
Totals	68,153,705	1.382,772,904	60,466,238	1,229,225,645

The following table shows the earnings and cost, in cents, per passenger per mile on each of the divisions, as compared with 1886 :

	Earnings per pass.-mile. 1887.	1886.	Cost per pass.-mile. 1887.	1886.	Profit per pass.-mile. 1887.	1886.
Main line and branches	2.263	2.245	1.728	1.797	0.535	0.448
United railroads of New Jersey	1.953	1.957	1.393	1.410	0.560	0.547
Philadelphia & Erie Railroad	2.605	2.624	2.034	2.046	0.571	0 578
All lines east of Pittsburgh and Erie	2.125	2.114	1.577	1.611	0.548	0.503

It will be seen from the above that the result upon all lines east of Pittsburgh and Erie was an increased earning per passenger per mile of 0.11 of a mill, and a decreased expense of 0.34 of a mill, the result being an increased profit of 0.45 of a mill per passenger per mile.

The average distance traveled by each passenger in 1887 over the main line and branches was 18.8 miles—the same as in 1886.

The following table shows the revenue and cost per ton per mile for freight transported on each division operated by the company, as compared with 1886, in cents:

	Earnings ton-mile. 1887.	1886.	Cost of transportation per ton-mile. 1887.	1886.	Profit per ton-mile. 1887.	1886.
Main line and branches	0.670	0.695	0.426	0.423	0.244	0.272
United railroads of New Jersey	1.285	1.327	1.103	1.066	0.182	0.261
Philadelphia & Erie Railroad	0.543	0.523	0.324	0.310	0 219	0.213
All lines east of Pittsburg and Erie	0 730	0.755	0.497	0.492	0.233	0.263

The result upon all lines east of Pittsburgh and Erie was a reduction in the earnings per ton per mile of one-quarter of a mill, and an increase in expense of movement of 0.05 of a mill, with the result of a decrease of 0.3 of a mill per ton per mile in the net profit from freight.

On the main line and branches the through freight eastbound increased one per cent. and west-bound 19.06 per cent.

The local freight shows an increase of 20.32 per cent. eastbound, and 13.72 per cent. west-bound. On the main line and branches the local tonnage represents about 92.5 per cent. of the entire traffic.

CONSTRUCTION AND EQUIPMENT ACCOUNT.

There has been expended for construction, equipment and real estate as follows:

Pennsylvania Railroad and branches	$2,714,679
United Railroads of New Jersey	1,146,671
Philadelphia & Trenton Railroad	217,097
*And for improvements and extensions on branch and auxiliary lines operated by the company	2,211,868
Total	$6,290,315
On account of these advances there has been received from some of the companies, in cash	680,138
Total amount expended on capital account in 1887	$5,610,177

* On account of these advances to branch and auxiliary lines there have been received in securities of those companies $1,178,821.

This amount was supplied by the use of capital stock.

The President calls attention to the fact that investments in the securities of other companies amount to $108,709,107, yielding a cash income of $4,488,027, "being largely in excess of your funded debt.

"The United Railroads of New Jersey Division continues to show a fair gain in the volume of both the freight and passenger business, more especially in the latter; but, as stated in the annual report for 1886, the exceptional expenses connected with its traffic have prevented your company from obtaining improved net results. It is gratifying to note, however, that the deficit occurring on this division arises almost entirely from the operations of the branch lines and of the Delaware & Raritan Canal. The net earnings of the main line between Philadelphia and New York were very nearly sufficient to provide for the entire dividends and fixed charges upon that portion of the system.

"The Philadelphia & Erie Railroad Division shows an improvement in both gross and net earnings, and was able to provide not only for all its fixed charges, but to appropriate a reasonable amount to the payment of obligations heretofore given for advances made by your company.

"The loss to your company upon the United Railroads of New Jersey slightly exceeded that of last year. The exceptional service required upon that division, in connection with the expensive character of its terminals, seems to preclude the possibility of operating it as economically as the other roads in your system.

"There were used on the main line, in construction and repairs, 28,168 tons of steel rails and 1,409,151 ties; on the United Railroads of New Jersey, 10,090 tons of steel and 536,386 ties; on the Philadelphia & Erie Railroad, 2,504 tons of steel and 153,656 ties—making a total of 40,762 tons of steel and 2,099,193 ties.

"There were built at Altoona and your other shops east of Pittsburgh and Erie, for the main line and other roads in your interest, on capital and repair account, 124 locomotives, 156 passenger cars, 11 baggage and mail cars, 2,609 freight cars and 180 cabin and maintenance of way cars.

"The lines comprising your western system show a marked improvement over the preceding year, there being a profit of $1,278,463 over and above all liabilities, as compared with $205,787 in 1886. The freight traffic shows an increase of 3,998,098 tons, and the passenger travel an increase of 1,146,013 in the number carried. Large expenditures were made in the purchase of additional real estate at terminal points, in the renewal of bridges and construction of branches, double track and sidings. The condition of the track and equipment was fully maintained.

"The amount expended during the year on capital account on the lines west of Pittsburgh was $2,608,504.

"The Grand Rapids & Indiana continues to show favorable results, its net earnings having been more than sufficient to meet the interest on its funded debt and the losses on its leased lines.

"The greater part of the amount expended during the past year on capital account was for increased facilities on your line between New York and Pittsburgh. The volume of business secured through the development of local industries promoted by the construction of branch and auxiliary lines had become so great as to compel your company to make unusual outlays in this direction, not only in the extension of third and fourth tracks, but in the purchase of additional real estate and equipment. The amount of construction work undertaken during the year, however, was so great that it was impossible to complete it, and considerable expenditure will be required during the current year to finish that now in progress. The four tracks are now laid on the greater portion of the road between Philadelphia and New York, with the exception of the expensive points in the larger cities. Your management is pursuing the policy of substituting stone for iron when the necessity arises for the renewal of the structure, and wherever it is possible to do so at reasonable cost. The aggregate sum expended for the purposes thus indicated was $4,078,447."

A large expenditure has been made in the extension and development of branch and auxiliary lines. This has been for additional tracks and real estate, the reduction of grades and for new construction. The aggregate has been $2,211,868, of which $680,138 was provided in cash and bonds by the branch and auxiliary lines.

"Authority was given to your company toward the end of the year by the Board of Public Works of Jersey City to elevate the tracks approaching the New York terminus. Should the business of the present year be of such a character as to warrant so large an expenditure this work will be commenced.

"The Alexandria & Washington Railroad, five miles in length, connecting the Baltimore & Potomac Railroad with the Alexandria & Fredericksburg Railway, was purchased during the year at judicial sale, under proceedings instituted by the city of Washington.

"The Employés' Relief Fund, established Feb. 1, 1886, has more than fulfilled the expectations of your management in the benefits enuring therefrom to such of the employés and their families as have availed themselves of the opportunity thus afforded for relief in case of sickness, accident and death. Your company and affiliated lines contributed during the year $56,701 for operating expenses, and in addition thereto the sum of $1,942 for extra benefits to members of the fund whose disability had continued over fifty-two weeks, and who were, therefore, no longer entitled to relief therefrom. The amount contributed by your employés was $341,192, the receipts from interest were $5,765, and the contributions by the companies $58,644, making a total of $405,600, which added to the balance on hand at the beginning of the year amounted to $515,407. Out of this fund there was paid to the families of employés in death benefits, and for sickness and accidents, the sum of $266,548, and for expenses $56,701, leaving a balance of $192,158. After deducting therefrom the amount of outstanding unadjusted claims, and setting aside a proper reserve fund to meet liabilities growing out of the increasing age of the members, there remained a net surplus of $111,913. There were 18,741 members of the fund at the close of the year.

"With a view of enabling your employés to safely and conveniently deposit such portion of their earnings as they might desire to accumulate, your company established, on Jan. 1, 1888, an Employés' Saving Fund, assuming the responsibility of the safe custody and repayment, with reasonable interest, of the moneys so deposited. The fund is now in successful operation, and will, no doubt, like the Relief Fund, be of value for the purpose indicated."